A HISTORY OF THE KERALA SCHOOL

OF HINDU ASTRONOMY

(IN PERSPECTIVE)

By

K. V. SARMA

VISHVESHVARANAND INSTITUTE

HOSHIARPUR'

1972

While mathematical and astronomical studies suffered a setback in North India from the 13th century, such studies continued uninterrupted in pockets like Kerala, in the south, far removed from the vortex of political and other tribulations. A proper evaluation of these investigations and a full account of the literature thereof has, all along, been a desideratum.

The present *History of the Kerala School of Hindu Astronomy* attempts to depict, in perspective, the contribution of Kerala to mathematics and astronomy, in six chapters devoted, respectively, to : I. *Some salient features of Kerala astronomy* ; II. *Anticipation of modern mathematical discoveries by Kerala astronomers* ; III. *Major trends in Kerala Jyotiṣa* : IV. *Kerala astronomers* ; V. *Bibliography of Kerala Jyotiṣa* and VI. *Bibliography of Kerala-based Jyotiṣa*. Of particular interest herein are ch. III, demonstrating the anticipation of several modern theorms, ch. IV, giving details of the lives and works of about eighty astronomers, and ch. V, identifying as many as 752 works and 111 authors, with full documentation such as manuscripts of the works, dates of authors and works, earlier writings and indication of the contents of the texts.

It is to be hoped that the present *History* will provide historians of mathematics with a fair idea of the contribution of Kerala to Hindu astronomy.

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By

K. V. SARMA

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and Indological Studies

प्रथमं संस्करणम् , २०२९ वि.

प्रकाशकृत् — विश्वेश्वरानन्द-संस्कृत-भारतभारती-अनुशीलन-संस्थानम् ,
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(पञ्गृहम्) साधु-आश्रमः, होश्यारपुरम् (पं०, भारतम्)

CONTENTS

P R E F A C E

The present work on the Kerala School of Hindu Astronomy grew out of my conviction about the sustained development of the twin disciplines of astronomy and mathematics, in that part of India, during mediaeval times, even after the period of Bhāskara II (b. A. D. 1114), from when on, it is uniformly presumed that Hindu mathematics had come to a standstill (see below, pp. 11-12). For a proper assessment of the said development, the premier requirement was an analytical and documented account of the extensive source materials on the subject, in Sanskrit and in Malayalam, as recorded, mostly, in palmleaf manuscripts Critical and comparative studies on individual topics, authors and works could follow, on the basis of the said account. And, the cumulation of such studies could be expected to set out the contribution of Kerala to Hindu astronomy, which would form a substantial chapter in the history of that discipline.

This volume is intended as a history 'in perspective', a necessary fore-runner to 'descriptive' and 'comparative' histories of the subject. The aim is to set out in broad 'perspective' the haracteristics of Hindu astronomy as it developed in Kerala (pp. 1-10), its major achievements and highlights (pp. 11-28), its main trends (pp. 29-40), a chronological account of the astronomers and mathematicians of Kerala (pp. 41-81), a fully referenced and documented survey of the literature on the subject produced in the land, with extracts from manuscripts and mention of earlier writings on them (pp 81-184) and a similar survey of the literature inspired by Keralite ideas, but produced beyond the borders of Kerala (pp 185-96).

The sections on 'Modern anticipations' (pp. 11-28) and on 'Major trends' (pp. 29-40) are bound to be highly instructive. So also are the sections on the 'Bibliography of Kerala Jyotiṣa' and the 'Bibliography of Kerala-based Jyotiṣa', in 115 pages, which form the burden of this book. In the former as many as 752 works and 111 authors have been identified and marked off with documentary evidence, and in the latter 118 works and 32 authors have been similarly treated.

Of the said 752 Kerala works, 402 pertain to astronomy and mathematics and 350 to astrology. Among the astronomical works, the *karaṇa* texts number 211 and works on general astronomy, 80. There are 34 works on eclipses, which either enunciate new methodologies, indicate revised calculations or describe eclipse computation. A very important type of texts, numbering 9, pertain to the exposition of astronomical rationale (*nyāya* and *yukti*). Works connected with the *Siddhāntas* number 6, with *Tantra* 34 and with mathematics 28. The above résumé would amply substantiate the claim for sustained astronomical investigation and literary activity in that subject in Kerala during the late mediaeval period.[1]

The survey, conducted as above, has resulted, as might be seen from the inventory of Kerala authors and works (pp. 85-184), in the identification of several hitherto unknown astronomers and the discovery of a large number of interesting texts, especially on *chāyā, grahaṇa* and *sphuṭakriyā* ; these can be distinguished in the said inventory by the absence of any reference to modern writings recorded below the respective entries. Among the identifications are included also the different versions and recensions of works like the *Kriyākramakarī, Goladīpikā* and *Nyāyaratna*. Several works bearing the same title, and authors having a common name have been identified. (See for example, *Uparāgakriyākrama* I-III, *Grahaṇagaṇita* I-X, *Grahaṇāṣṭaka* I-IV, *Pañcabodha* I-XI, *Muhūrtapadavī* I-VII ; Dāmodara I-III, Nārāyaṇa I-VIII, Puruṣottama I-III, Śaṅkara I-IX etc.). A number of additions, correlations, and corrections to existing views could also be made which would be apparent on a reference to entries such as Acyuta II (see also p. 184), Āzhvāñceri Tamprākkaḷ, Ghaṭīgopa, Citrabhānu-Śiṣya (see also p. 184), Jyeṣṭhadeva, Nārāyaṇa I, Nīlakaṇṭha I, Parameśvara I, Putumana Somayāji, Mādhava I, Śaṅkara Vāriyar of Tṛkkuṭaveli, Śaṅkaran Nampūtiri of Mahiṣamaṅgalam, *Muhūrtapadavī, Horā* etc. Of special significance in the matter of ingenuity is the *Veṇvāroha* of Mādhava and the genre of texts based on its method. Among the numerous new works discovered, two deserve special mention, viz., the *Grahaparīkṣākrama* of Nīlakaṇṭha Somayāji and the *Sūryasiddhānta-vyākhyā* of Acyuta Piṣāraṭi. As a matter of fact, it is quite possible that further examination of the manuscript

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1. It might be mentioned here that S.N. Sen's *Bibliography of Sanskrit works on astronomy and mathematics,* (National Institute of Sciences of India, New Delhi, 1966), records only about 660 works, *in all, for the whole of India.*

repositories in Kerala is likely to result in more discoveries and identifications.

This volume is primarily the outcome of the researches which I carried out as a University Research Scholar under the supervision of Prof. V. A. Ramaswami Sastri, concurrently with my duties as the Supervising Pandit of the Cataloguing Section of the University Oriental Manuscripts Library, Trivandrum. My intimate association, later, with the compilation of the *New Catalogus Catalogorum of Sanskrit Works and Authors* at the Madras University also proved to be of great help in my work. The thrill at discovering the thitherto unknown basic of text of the *Parahita System* of Kerala astronomy, *viz.*, the *Grahacāranibandhana* of Haridatta (*c.* A. D. 650-700) and, subsequently, of the basic text of the *Dṛk System, viz.*, Parameśvara's *Dṛggaṇita*, which had been proclaimed by all earlier scholars as irrevocably lost, sustained me through the heavy strain involved in examining several hundreds of palmleaf manuscripts, identifying, studying and correlating works on Jyotiṣa. Another factor which kept up the tempo of the investigations, during later years, was the flow of queries from the late savant, Vaṭakkumkūr Rajaraja Varma, who was then writing his 6-volume *History of Kerala Sanskrit literature* and 2-volume Supplement to Ulloor's *History of Kerala literature*. I cherish the privilege I had in supplying him with substantial literary information in that connection, which he has generously acknowledged at several places in his said books, particularly in the Preface to vol. I of the latter work and in the general reference he has made on pp. 508-9 of vol. VI of the former.

The magnificent Manuscripts Library of the Kerala University, which is the largest repository of Kerala manuscripts, has, naturally, been the prime source of my basic materials. I am indebted to the successive Directors of that Library, to wit, Prof. V.A. Ramaswami Sastri, Dr. P.K. Narayana Pillai and Dr. K. Raghavan Pillai, and to Dr. L.A. Ravi Varma, who was in charge of the Maharaja's Palace Library, Trivandrum, for the facilities they afforded towards my studying the materials available at these centres. Thanks are due, for similar facilities, also to the authorities of certain other manuscript repositories, especially the Govt. Oriental Mss. Library, and the Adyar Library, Madras, the Sanskrit College Library, Trippunithura, the S.V. Oriental Institute, Tirupati, and our own Vishveshvaranand Institute, Hoshiarpur. Among the private collections

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Ad.　　　　Adyar Library, Madras. Ref. to the Library's *Alphabetical Index of Mss.*, Madras, 1944.

Bala.　　　K. Balagangadharan, 'A consolidated list of Hindu mathematical works', *Mathematics Student*, 15 (1947) 55-70.

Baroda　　Oriental Institute, Baroda. Ref. to its *Alphabetical list of Mss.*, 2 vols., Baroda, 1942, 1950.

C¦　　　　Curator's office Collection of Skt. Mss., deposited in the Kerala Univ. Mss. Library, Trivandrum.

CC　　　　*Catalogus Catalogorum, An alphabetical register of Skt. works and authors*, by T. Aufrecht, Leipzig, 3 vols., 1891, 1896, 1903 ; Rep. Wiesbaden, 1962.

CM　　　　Curator's Office ¦Collection of Malayalam Mss., deposited in the Kerala Univ. Mss. Library, Trivandrum.

Gaṇaka.　　*Gaṇakataraṅgiṇī or Lives of Hindu astronomers* (in Skt.), by Sudhakara Dvivedi, rev. by Padmakara Dvivedi, Banaras, 1933.

IO　　　　India Office, London. Ref. to its *Cata. of Skt. and Pkt. Mss.*, by J. Eggeling, (2 Pts., London, 1887, 1896) ; and A. B. Keith, (2 Pts., London, 1935).

Kaye　　　G. R. Kaye, 'A brief bibliography of Hindu mathematics', *Jl. and Proc. of the Asiatic Soc. of Bengal*, (NS), 7 (1911) 679-86.

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Ker. Astron. K.V. Sarma, *A history of the Kerala school of Hindu astronomy* (*In perspective*), Vishveshvaranand Institute, Hoshiarpur, 1972.

Ker. Mal. Kerala Univ. Mss. Library, *Index of Malayalam Mss.*, Trivandrum, 1951.

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L Loan Collection of Mss., deposited in the Kerala Univ. Mss. Library, Trivandrum.

Lucknow, Skt. Parishad. See below, p. 186.

Mad. Madras, Govt. Or. Mss. Library. Nos. preceded by 'D' denote mss. described in its *Des. Cata. of Skt. Mss.* and those preceded by 'T' denote mss. described in its *Triennial Cata. of Mss. (Skt.)*

Mysore See p. 186.

NCC *New Catalogus Catalogorum : An alphabetical register of Skt. and allied works and authors*, by V. Raghavan, K.K. Raja, University of Madras, 1949 ff.

Nepal Vir. See below, p. 186.

P Palace Library Collection of Skt. Mss., Trivandrum, deposited in the Kerala Univ. Mss. Library.

PG P. Govinda Pillai, *Malayala Bhasha Charitram* (in Mal.), rep. National Book Stall, Kottayam, 1955.

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Raj. Jaina See below, p. 186.

Raj. Jodh. See below, p. 186.

Raja K.K. Raja, 'Astronomy and mathematics in Kerala (An account of its literature)', *Adyar Library Bulletin*, 27 (1963) 118-67.

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T — Transcripts Section (Skt.) of the Kerala Univ. Mss. Library, Trivandrum.

Tanjore — Tanjore, Sarasvati Mahal Library. Nos. preceded by 'D' denote mss. in its *Des. Cata. of Skt. Mss.*

Tir. — Triupati, S.V. Or. Institute : *Alphabetical Index of Skt., Telugu and Tamil Mss.*, Tirupati, 1956.

TM — Transcripts Section (Malayalam) of the Kerala Univ. Mss. Library, Trivandrum.

Ul. — Ulloor S. Parameswara Aiyar, *Kerala Sahitya Charitram* (History of Kerala literature), (in Mal.), Univ. of Kerala, Trivandrum, 5 vols., 1953-57.

Ul. Sup. — Sup. to Do. : *Kerala Sahitya Charitram—Charcchayum Purāṇavum*, (in Mal.), by Vaṭakkumkūr Rajaraja Varma, Mangalodayam, Trichur, 1967, 1969.

Va. — Vaṭakkumkūr Rajaraja Varma, *Keraliya Samskrita Sahitya Charitram* (History of Kerala Skt. literature), (in Mal.), vol. I, Kamalalaya Bk. Depot, Trivandrum, M.E. 1113 (A.D. 1938) ; vols. II-VI, Mangalodayam, Trichur, M.E. 1122-40 (A.D. 1947-65).

Varanasi — See below, p. 186.

V.V.R.I. — See below, p. 186.

Whish — Whish Collection of mss., described in *A Cata. of Indian Skt. Mss. (especially those of the Whish collection) in the Royal Asiatic Soc.*, London, by M. Winternitz, London, 1902.

GENERAL ABBREVIATIONS

arith.	Arithmetic
astrol.	Astrology (general)
astron.	Astronomy (general)
C	Commentary
ecl.	Eclipse
jā.	Jātaka
kar.	Karaṇa
Ker. (?)	Kerala authenticity doubtful
Mal.	Malayalam
Ms(s).	Manuscript(s)
muh.	Muhūrta
nat. astrol.	Natural astrology
pra.	Praśna
Skt.	Sanskrit
TSS	*Trivandrum Skt. Series*

SOME SALIENT FEATURES OF KERALA ASTRONOMY

1. Introduction

Mathematics and astronomy are two of the scientific disciplines to which significant contributions have been made, down the centuries, by Kerala scholars. The land of Kerala, a narrow strip of territory tucked away between the Western Ghats and the Arabian sea, produced superb mathematicians from very early times. The fervour with which the sister science of astrology, in its different branches, was cultivated, had had the beneficial effect of promoting the study of mathematics and astronomy, for the latter provided the basic framework for the practice of the former. The social structure which confined mainly, to certain sections of the community, the study of these disciplines and the freedom from political or religious upheavals which Kerala enjoyed helped the uninterrupted development, here, of these sciences. As a result of all this, significant strides were made and a very large number of treatises came to be written, down to the 19th century, in these disciplines. However, only a fraction of these works have come down to us, the bulk having been lost on account of the ravages of time and the inclement climate of the land which had a highly detrimental effect on the palmleaf manuscripts on which these works had been inscribed. The highly conservative outlook of the custodians of extant manuscripts of these technical texts, the local Malayalam language in which many of these works have been composed or commented upon and the rather obscure Malayalam script used for writing the manuscripts have all stood in the way of a proper study and interpretation of these works in terms of modern mathematics and thereby institute a proper evaluation thereof. In fact, modern scientific studies on Kerala astronomy have been based mainly on just a handful of texts as have, so far, been made available in print, out of the few hundreds of texts still available in the form of manuscripts.

2. Spirit of enquiry

At the outset, a reference might be made to the mental outlook and spirit of enquiry that characterised Kerala astronomers and

mathematicians in their investigations. Parameśvara of Vaṭaśreṇi (c. 1360-1455), who revised the then prevailing *Parahita* system of computation and evolved new methods in his work entitled *Dṛggaṇita*,[1] makes a revealing statement in this regard, in the beginning of that work. He says :

dṛśyante vihagā dṛṣṭyā bhinnāḥ parahitoditāḥ |

*pratyakṣadṛṣṭāḥ spaṣṭāḥ syur grahāḥ śāstreṣv itīritam ||*I·1.2 ||

satkarmoditakalasya grahā hi jñānasādhanam |

aspaṣṭavihagaiḥ siddhaḥ kālaḥ śuddho na karmaṇi || 3 ||

ye tu śāstravidas tadvad golayuktividaś ca taḥ |

sphuṭakhecaravijñāne yatnaḥ kāryo dvijair ataḥ || 4 ||

sañcintyeti samālocya pūrvatantrāṇi yatnataḥ |

sphuṭayuktim khecarāṇām goladṛṣṭyā samīkṣya ca || 5 ||

sphuṭakhecaravijñānam śiṣyair yaiḥ prarthitam dvijaiḥ |

tebhyo Dṛggaṇitam nāma gaṇitam kriyate mayā || 6 ||

'(The positions of) the planets derived according to the *Parahita* (system of computation) are found to be different (from their actual positions) as seen by the eye. And, in authoritative texts (*śāstra*) it is said that (only) positions as observed (should be taken) as the true ones. (I. i. 2).

'(The positions of) the planets are the means of knowing the times specified for (the performance of) meritorious acts. (Here), times calculated from incorrect (positions of) planets will not be auspicious for those) acts. (3)

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1. K. V. Sarma, *The Dṛggaṇita of Parameśvara*, Cr. ed. with Introduction, Hoshiarpur, 1963. Parameśvara is reputed to have made continuous astronomical observations for 55 years with the help of instruments : Cf. what Nilakaṇṭha Somayājin, who received instruction from Parameśvara, says in his *Āryabhaṭīya-bhāṣya* (Gola, 43) : *Parameśvarācāryeṇa punaḥ grahaṇa-grahayogādikam yantraiḥ pañcapañcāśad-varṣakālam samyak parīkṣitam. Aha caivam...''grahendrāḥ pañcapañcāśad-varṣakālapadantare"* etc. (*Trivandrum Skt. Ser.*, No. 185, p. 154).

'Hence, efforts should be made for knowing the true (positions of) planets by those who are learned in the sciences and by those who are experts in spherics. (4)

'Cogitating thus, and painstakingly studying the ancient texts and observing well the true positions of the planets according to the spherics, I am composing a manual on astronomy for the twice-born disciples who requested for a knowledge of the true (positions of the) planets'. (6).

3. Stress on observation and experimentation

An insight into the mediaeval astronomer's methodology, which consisted of prolonged and repeated observation, experimentation, recording of readings, checking of the values obtained from observation with those obtained by computation and the postulation of corrections (samskāra), in order to make computation correspond with observation, might be illustrated by certain statements which Parameśvara makes elsewhere. In his sub-commentary Siddhāntadīpika on the Mahabhās-karīya-bhāṣya of Govindasvāmin,[1] he has a long excursus on a number of eclipses which he had observed carefully and about which he had recorded the details, with a view to effecting necessary corrections to prevailing rules of computation or for formulating new rules therefor (op. cit., pp. 321-32). He commences the said excursus with the statement that he had been observing eclipses from Śaka 1315 (A.D. 1393), that he had found the observed times to have always preceded the computed times and, so, the computations needed corrections :

'tithiviśva'-(1315)-same śāke prārabhya grahaṇam mayā |

anekam īkṣitam, teṣu bhinnaḥ kālo dṛśa sadā || 2 ||

pratyakṣakalas teṣu prāg gaṇitānītakālataḥ |

ataḥ kāryo 'tra saṁskāro yaḥ kaścid gaṇakottamaiḥ || 3 || (p. 321)

He then enunciates the True positions of the Sun, Moon, Moon's higher apsis and node at sunrise for a particular contemporary date as calculated by the application of the corrections proposed by him,

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1. T. S. Kuppanna Sastri, Cr. ed. of Mahābhāskarīya of Bhāskarācārya with the Bhāṣya of Govindasvāmin and the super-commentary Siddhāntadīpikā of Parameśvara, Madras, 1957.

so as to form the zero-readings for calculations beginning from that date. He also suggests that verifications should be made in course of time and further corrections postulated and applied as and when needed :

> asmin kāle tu ravīnduccapātānam sthitir īdṛśī |
>
> etatsiddhyartham asmābhiḥ samskārāntaram ādṛtam // 91 //
>
> ...   .
>
> kālāntare tu saṃskāroś cintyatām gaṇakottamaiḥ //93// (p.332)[1]

4. Concern for accuracy

The concern of these astronomers for accuracy in the results of computations is reflected in a statement, again by the same author, in another work of his. Towards the close of an extensive work on the computation of eclipses, entitled *Grahaṇamaṇḍana*,[2] Parameśvara observes, in all humility, that the times of contact etc. as obtained through the calculations enunciated in that work *may, at times,* differ slightly from observed positions.[3] He hastens to add that these small differences must be due to factors which he could not take into account or which had not been identified thus far. But, as a practical scientist, he is confident that it would be possible to postulate, as a result of further observations and experimentations, the necessary corrections by the application of which even these small differences could be eliminated :

> śāstrād alabdha ekaḥ samskāro grahaṇakarmaṇi ravīndvoḥ |
>
> asty eveti ca kalpyaḥ gaṇakavarair yuktividbhir ataḥ // 98 //
>
> dṛṣṭvā bahuparāgān sañcintya ca golayuktim iha gaṇakaiḥ |
>
> kalpyaḥ sa tu samskāras tasmād, athavā gurūpadeśena // 99 //

5. Researcher's outlook

The endeavour among Kerala astronomers for continuous

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1. On Parameśvara's astronomical observations, see K. V. Sarma, 'An-pattiyañcu kollatte tapassu' ('Fifty-five years' penance'), *Mathrubhumi* (Mala-yalam Weekly, Kozhikode), 7.10.1956, pp. 29-30.

2. K.V. Sarma, *Grahaṇamaṇḍana of Parameśvara*, Cr. ed. with Introduction, Translation and Appendix, Hoshiarpur, 1965.

3. Cf., *Ibid.* : kālo 'nena ca siddhaḥ kadācid api bhidyate svalpam //66//

efforts at improving their results is reflected in the enunciation by Parameśvara in a later work of his, viz. *Dṛggaṇita*, a correction to one of his earlier works, the *Grahaṇamaṇḍana*. This correction which is to be applied to the Mean positions of the Sun, Moon, Higher apsis and Node as calculated according to the *Grahaṇamaṇḍana* is given at the close of his *Dṛggaṇita*, II. 47-50, with the introductory statement :

kāryo grahesu Grahaṇamaṇḍanoktesv ataḥ param |

saṁskāras tam ca vakṣyāmi tatra noktam yato mayā || II. 47 ||

6. Continuity of tradition

Still another significant characteristic of Kerala astronomy and mathematics relates to the regular continuity of traditional knowledge that was handed down from father to son or from teacher to disciple, in succession. Some of the known lines of tradition extend through several centuries. An old palmleaf document discovered and published by the present writer[1] records a line of tradition which extends from the 13th to the 17th centuries : Govinda Bhaṭṭatiri of Talakkuḷam (1237-95)→pupil : grandfather of Parameśvara (13th-14th cent.) → grandson-pupil : Parameśvara (c. 1360-1455) → son : Dāmodara (15th cent.) → pupil : Nīlakaṇṭha Somayāji (1444-1545) → pupil : Jyeṣṭhadeva (c. 1500-1600) → pupil : Acyuta Piṣārati (1550-1621). Another similar astronomical chronology recorded in the *Āranmula-vilāsam Haṁsappāṭṭu* by Kṛṣṇan Āśān, author of *Bhāṣa-Jatakapaddhati*, carries the above-noted tradition to the beginning of the 19th century ;[2] Acyuta Piṣārati (1550-1621) → pupil : Tṛppāṇikkara Potuvāḷ → pupil : Nāvāyikkuḷattu Āzhāti → pupil : Pulimukhattu Poṭṭi (1686-1758) →pupil : Rāman Āśān (18th cent.) → son : Kṛṣṇan Āśān (1756-1812) This line continues as follows : Kṛṣṇadāsa (1756-1812) → pupil : Dakṣiṇāmūrti Mūssatu of Maṅgalaśśeri, in Āranmula (18th-19th cent.) → pupil : Bālarāman Piḷḷa of Nālēkāṭṭil family of Mānnār (19th cent.) → pupil : Prince Rājarāja Varma (Vidvān Karīndran Ceruṇṇi

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1. K.V. Sarma, 'Direct lines of astronomical tradition in Kerala', *Pt. Charu-deva Shastri Felicitation Volume*, Delhi, 1972 ; 'Oru Jyotiṣa-granthavari' (An astronomical document), (in Malayalam), *Mathrubhumi* (Kozhikode, Kerala), 19.5.1957.

2. See Ulloor S. Parameswara Aiyar, *Kerala Sāhitya Charitram*, (*History of Kerala literature*), Vol. II, (Trivandrum, 1954), pp. 321-22.

Koyittampurān of Kilimānūr) (1812-46).[1]   The importance of the continuity of tradition in a practical, demonstrative discipline like astronomy, at a time when there was not a proliferation of printed books and public schools, is self-evident. And, the part played by these traditions in keeping alive the torch of astronomical enquiry in Kerala cannot be underestimated.

7. Basic features of Kerala astronomy

(a) *Adherence to the Āryabhaṭan system.* From at least the 7th century, if not earlier, Kerala had been the bastion of the Āryabhaṭan school of astronomy. While the view expressed in certain quarters that Āryabhaṭa hailed from Kerala[2] has yet to be substantiated, there is no doubt about the extensive popularity of this system in the land. The later Kerala schools are all based on the Āryabhaṭan system. Most of the known commentaries on the *Āryabhaṭīya* have been written by Kerala mathematicians. Well-nigh, every one of the scores of astronomical works produced in Kerala follow the *Āryabhaṭīya* basically. And, the efforts of Kerala mathematicians have generally been directed towards the revision, supplementation and correction of Āryabhṭan astronomy and mathematics with a view to deriving more accurate results.

(b) *Kaṭapayādi notation.* An extremely convenient method of expressing numbers through letters, known as the *Ka-ṭa-pa-yādi* notation, has been extensively used in Kerala from very early times. A legendary author named Vararuci is credited with this innovation and the authorship of the popular collection of *Candra-vākyas* or *Vararuci-vākyas* ('Moon computation sentences'), composed in this notation. The *Grahcāranibandhana* of Haridatta (A.D. 683) also uses this notation extensively. In this notation, each of the four series of consonants beginning with *k, ṭ, p,* and *y* in the Sanskrit alphabet stands for the digits 1 to 9. In conjunct letters, the value only of the final consonants is to be taken into account. Vowels following the consonants have no value. *n* and *ñ* and the pure vowels stand for zero.

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1. *Ibid.*

2. For the latest essay in this direction, see K Damodaran Nambiar, 'Aryabhaṭan', *Mathrubhumi* (Malayalam Weekly, Kozhikode, Kerala). Oct. 18, 1970, pp. 15-16, 41.

The letter *l*, which is peculiar to Dravidian denotes 9.[1] The versatility of the notation rests in the fact that even long and intricate numbers can be expressed through apparently meaningful expressions and verse-bits, facilitating their easy verification and memorisation.[2] The numerous sine and other mnemonic tables which form a characteristic feature of the Kerala School of astronomy are couched in this notation.

(c) *Basic principles.* In their mathematical work, Kerala authors and, for that matter, Indian authors in general, based themselves on the fundamentals of arithmetic, algebra, geometry and trigonometry. They were aware also of properties of numbers, to some extent. Calculus and higher mathematics, as developed in the West during the last three hundred years, were not known, but strict application of geometry, trigonometry and algebra, coupled with clear analytical thought and intuition, have enabled Kerala astronomers to arrive at important results and enunciate theorems which were later rediscovered in the West, some after several centuries.[3]

8. Parahita system of astronomy

A significant event in the annals of Kerala astronomy was the promulgation, in A. D. 683, of the *Parahita* system by Haridatta (*c.* 650-700) through his *Grahacāranibandhana*[4] and *Mahāmārga-*

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1. The simple rule for this notation is given by the verse :

na-ñāv acaś ca śūnyāni, saṅkhyāh ka-ṭa-pa-yādayah /

miśre tūpāntahalsaṅkhyā, na ca cintyo halah svarah //

Sadratnamālā of Śaṅkara Varman

2. See *e.g.*, the chronogram '*ācāryavāg abhedyā*' which is kali day 1434160, on which Śaṅkarācārya introduced certain reforms ; and the Moon-sentence, '*gīr nah śreyah*' denoting 0°—12'—3''.

3. For a resume of the more important of these anticipations. see below, Ch. II.

4. Cr. ed with Intro. by K. V Sarma, K.S. Research Inst., Madras, 1954. On the discovery and identification of this thitherto unknown basic text of the *Parahita* system see K. V. Sarma, 'Parahita-gaṇitattinte mūlagrantham', *Mathrubhumi* (Mal. Weekly, Kozhikode), Oct. 10. 1954.

nibandhana.[1] The event is recorded in several later works. For instance, the *Sadratnamāla* of Śaṅkaravarman says :

ācāryāryabhaṭapraṇītagaṇitam prāyaḥ sphuṭam tat kalau
'gotroṭtuṅga'-(3623)-mitābdake vyabhicaran brahmādisiddhāntake |

...   .

dṛgvaiṣamyavaśāt 'mahāsthala'-(3785)-mite kalyabdake niścitaḥ

saṁskāro vibudhair yataḥ parahitatvam teṣu vīneṣv ayam || (6.1, 3)

'The astronomical treatise composed in Kali 3623 (A.D. 522) by Āryabhaṭa gave well-nigh accurate results, whereas the *siddhāntas* ascribed to Brahmā etc. had (by that time) tended to be inaccurate. (When its results too tended to be inaccurate, as exemplified by their) not tallying with observation, the correction called *Parahita* was adopted by the wise in Kali 3785 (A.D. 683) for the planets other than the Sun'.[2]

Tradition says that the inauguration of the system took place on the occasion of the twelve-yearly *Māmāṅkam* (*Mahā-magha*) festival held at Tirunāvāy on the Malabar coast.[3]

Haridatta based his system on the *Āryabhaṭīya*, but improved upon it in several ways. He made computation easier by specifying simple multipliers and divisors for the various calculations, including the derivation of the positions of the planets. His use of the *Kaṭapayādi* notation made his composition elegant. He introduced the unique system of enunciating graded tables of the Sines of the arcs of Anamoly and of Commutation of the different planets (*Manda-jyā* and *Śīghra-jyā*) at intervals of 3° 45', to facilitate the computation of the true positions of the planets. His *Grahacāra-nibandhana* being only the computation manual of the system, deals,

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1. This seems to be the full-fledged theoretical treatise of the *Parahita* system while the *Grahacāranibandhana* is only its working manual. Manuscripts of this work have not yet come to light ; the work is known through its reference by Haridatta himself in the *Grahacāranibandhana.* 3. 44.

2. For other references to this event and the identity of Haridatta and his works, see K.V. Sarma, *Grahacāranibandhana*, op. cit., Intro., pp. v-ix.

3. See *ibid.*, pp. vi-vii ; Ulloor S. Parameswara Aiyar, *Kerala Sahitya Charitram*, vol. I, (Trivandrum. 1953), p. 165.

mainly, with the calculation of the Kali days elapsed, *tithi* and *nakṣatra* of any day, the mean and retrograde motion of the planets and their Mean and True positions. One of the corrections introduced by Haridatta to make Āryabhaṭan results more accurate, is called *Bhaṭa-saṁskāra* or *Śakābda-saṁskāra* (on account of its being calculated for the years beginning from the 'śakābda' of Āryabhaṭa, *viz.,* 444), and is particularly significant. This correction specifies that for every completed year after Śaka 444, a correction in minutes *(kalā)* of —9/85, —65/134, —13/32, + 45/235, + 420/235, —47/235, —153/235 and +20/235 should be made to the Mean positions of the Moon, Moon's apsis, Moon's node, Mars, Mercury, Jupiter, Venus and Saturn, respectively, no correction being necessary in the case of the Sun.[1]

A large number of astronomical manuals based on the *Parahita* system, including a *Grahacāranibandhana-saṅgraha,*[2] have come to be composed during later times, both in Sanskrit and in Malayalam, each taking off from a convenient contemporary epoch *(khaṇḍa-dina)* for which the True positions of the planets would have been fixed after elaborate calculations, these positions being used as zero-corrections for computation according to these manuals. Some of these incorporate also further corrections.

9. Dṛk system of astronomy

The *Dṛk* system promulgated by Parameśvara of Vaṭaśreṇi *(c.* 1360-1455), through his *Dṛggaṇita,*[3] is, as pointed out above (§2), a revision of the *Parahita* system and was composed with a view to make the results of computation accord with observation. While no new methodology is enunciated here, new multipliers and divisors are given for the derivation of the Kali days and for the calculation of the Mean positions of planets. Minute corrections are given

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1. The verse giving this correction reads as follows :

'*vagbhavo*' (444) *nāc chakābdāt dhana-śata-laya-hān manda-vailakṣya-rāgair āptābhir liptikābhir virahitatanavaś candra-tattuṅga-pātaḥ / śobhā-nirūdha-saṁvid-gaṇaka-nara-hatān māgar-āptāḥ kujādyāḥ saṁyukta jñāra-saurā virahitatanukau jīvaśukrau, na bhānoḥ //*

2. Ed. K. V. Sarma, as Appendix to the edn of *Grahacāranibandhana,* Madras, 1954.

3. Cr. ed. by K V. Sarma, with Intro. V.V.R. Inst., Hoshiarpur. 1963.

for these positions after long periods of time. Revised values are given for the positions of planets at zero Kali. Also, the values of the sines of arc of Anomaly (*Manda-jyā*) and of Commutation (*Śīghra-jyā*) are revised and given for intervals of 6 degrees.[1]

As in the case of the *Parahita* system, a large number of manuals have come to be composed following the *Dṛk* system, both in Sanskrit and in Malayalam. The results obtained through this system being more accurate, this system was used for horoscopy (*jātaka*), astrological query (*praśna*) and the computation of eclipses (*grahaṇa*), while the *Parahita* continued to be used for fixing auspicious times for rituals and ceremonies (*muhūrta*). In order to cater to both the purposes, some of the later manuals have dealt with both the *Dṛk* and *Parahita* systems.

1. On Parameśvara and the *Dṛk* system in general, see Intro. to *Dṛgganita*, op. cit., pp. x-xiii. See also, K.V. Sarma. 'Parameśvara's *Dṛgganita*', *Mathrubhumi* (Kozhikode), Aug. 28, 1960, pp. 19-21.

CHAPTER II

ANTICIPATION OF MODERN MATHEMATICAL DISCOVERIES BY KERALA ASTRONOMERS

1. The background

In the light of the trends that developed in the study and practice in Kerala of the twin sciences of astronomy and mathematics, as indicated in the last chapter, it need not be surprising that some of the significant findings of modern mathematics are found anticipated in the astronomical works produced during the mediaeval times in that region. In their endeavour to make the results obtained by computation accord with observation, the Āryabhaṭan school of astronomers of this corner of India made substantial advancement in their computational skill. Working on the basic principles of algebra, geometry and limiting values, they produced, by dint of shrewd thinking and logical reasoning, coupled with a fund of intuition, significant results on such matters as the reduction to the ecliptic, summations and associated integrations leading up to the value of π etc. Especially, the achievements connected with π were brought to the notice of scholars by Charles M. Whish who presented a paper on the subject before the Royal Asiatic Society in 1832.[1] Among other things, Whish set out in this paper the several formulae enunciated in four Keralite works on astronomy and mathematics, viz., *Tantrasaṅgraha, Yuktibhāṣa, Karaṇapaddhati* and *Sadratnamālā*, for the circumference of a circle in terms of its diameter and transformations of the infinite series for π associated with the name of Leibnitz.

The significance of the findings of Whish was hardly taken note of by historians of mathematics or of Indian literature, for more than a century. Instead, the view continued to prevail that Indian astronomy and mathematics were mostly borrowed from the West and that, at least since Bhāskara II, little original contribution was made by India to

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1. C.M. Whish, 'On the Hindu quadrature of the circle, and the infinite series of the proportion of the circumference to the diameter exhibited in the four Śāstras, the *Tantrasamgraham, Yucti-bhasha, Carana Padhati* and *Sadratnamāla*', *Trans. Royal Asiatic Soc. of Gr. Britain and Ireland,* 3 (1835) 509-23.

these disciplines.[1] The credit for launching, in the 1940-s, a detailed study of the discoveries of Whish in terms of modern mathematics goes to Prof. C.T. Rajagopal and his students and colleagues, including K. Mukunda Marar, A. Venkataraman, T.V. Vedamurthi Aiyar and K. Balagangadharan. The valuable notes added by Rama Varma Maru Thampuran and A.R. Akhileswara Aiyar to their excellent edition of the First Part of *Yuktibhāṣā*, (Trichur, Kerala, 1948), an expository work in Malayalam, new light on whose date and authorship has recently been thrown,[2] is another significant contribution in this direction. More recently, some other scholars like T. S. Kuppanna Sastri, T. A. Saraswathi and R.C. Gupta have been making valuable contributions to connected topics. The attempt made herein below to present, in a succinct form, the results of the investigations of the said scholars and those of the present writer which lie scattered in different books and periodicals, will, it is to be hoped, give a bird's-eye view of the significant contributions of Kerala savants to mathematics and astronomy.

2. Tycho Brahe's Reduction to the ecliptic

In astronomical computations, the longitude of a planet is measured along the ecliptic, while, in fact, its motion takes place along its own orbit which, generally, deviates slightly from the ecliptic. For an accurate computation of the planet's position this deviation has to be taken into consideration. In the West, it was

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1. *Vide*, for instance, G.R. Kaye: "After the time of Bhāskara (born A D. 1114), no Indian mathematical work of historical value or interest is known." (*Indian mathematics*, Calcutta, 1915, p. 24) ; A. B. Keith : "After Bhāskara, no progress can be recorded in Indian astronomy." (*A history of Indian literature*, Oxford, 1929, p. 523) ; A. A. Macdonell : "The last eminent Indian astronomer was Bhāskarācārya, born in A.D. 1114." (*A history of Sanskrit literature*, Indian rep., Delhi, 1962, p. 370); D. Arka Somayaji, "Bhāskara is the last name in the field. Barring a number of commentators, no name worthy of mention is there in India subsequent to Bhāskara." (*A critical study of the ancient Hindu astronomy*, Dharwar, 1971, p. 3). Standard historians of mathematics like Cantor, Cajori and D.E. Smith, too, hold the same view. The first Western historian of mathematics to take note of Whish's findings would appear to be A. P. Juschkewitsche in his *Geschichte der Mathematic Mittelalter*, (Leipzig, 1964), as pointed out to C. T. Rajagopal by D. T. Whiteside, the eminent Cambridge authority on Isacc Newton.

2. K. V. Sarma, 'Jyeṣṭhadeva and his identification as the author of *Yuktibhaṣā*', *Adyar Library Bulletin*, 22 (1958) 35-40.

the Danish astronomer Tycho Brahe (1546-1601) who enunciated a formula for this 'Reduction to the ecliptic'.[1]

In India. a formula for this Reduction was enunciated, for the first time, by a contemporary Kerala astronomer Acyuta Piṣārati (1550-1621), author of Rāśigola-sphuṭānīti ('Computation of True longitude on the celestial sphere')[2] and several other works on astronomy. Acyuta gives his formula for this reduction in the case of the moon in his work entitled Sphuṭanirṇaya ('Computation of true longitudes of planets') in the following verse :

pātonasya vidhos tu koṭibhujayor jīve mithas tāḍayet

antyakṣepaśarāhatam vadham amum vikṣepakoṭyā haret |

labdham vyāsadaloddhṛtam himakare svarṇam, vipāte vidhau

yugmāyugmapadopage ; vidhur ayam spaṣṭo bhagole bhavet ||

'Multiply the tabular cosine (*koṭijyā*) and sine (*bhujajyā*) of the moon-minus-node and the product by the tabular versine (*śara*) of the maximum latitude (*antya-kṣepa*) of the moon. Divide this by the tabular cosine of the latitude at the particular moment and the quotient is to be divided again by the tabular radius (*vyāsadala*). The result (will give the correction for longitude which) is to be added to or subtracted from the moon's longitude, as the moon-minus-node is in an even or an odd quadrant, respectively. The True Moon measured on the ecliptic is thus got'.[3]

Acyuta's formula may be expressed in terms of modern mathematics thus : 'If F is the longitudinal difference between the node and the planet, w the maximum latitude and y the actual latitude, then, the correction $k = \sin F.\ \cos F\ (1 - \cos w)\ /\ \cos y$.[4]

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1. *Vide* his *Astronomiae instauratae Progymnasmata,* Vol. I. Prague, 1602.

2. K. V. Sarma, *The Rāśigolasphuṭānīti,* (On the calculation of true longitude on the celestial sphere and Reduction to the ecliptic in Indian astronomy), Critical ed. and Tr. with Introduction, Adyar Library and Res. Centre, Madras, 1955.

3. This verse has been extracted by the author in his *Rāśigola-sphuṭānīti,* verse 47, *op. cit.,* p. 29.

4. For a demonstration of the correctness of this formula in terms of modern mathematics, see K.V. Sarma, *op. cit.,* Introduction, pp. 10-13.

In another of his works, *viz. Uparāgakriyākrama* ('Procedures in the computation eclipses'), Acyuta gives also a simplified version of the said formula.[1]

The actual date of composition of the *Sphuṭanirṇaya*, which is the earliest work to enunciate the reduction formula, is not known, but it is definitely before 1583 which is the date of composition of the *Uparāgakriyākrama* which contains the simplified formula.[2]

3. Newton-Gauss Interpolation formula

It has been demonstrated in detail that Indian mathematics employed, in its search for better results, improved rules of interpolation, by using the second differences and that a particular case, upto the second order, of the more general Newton-Stirling interpolation formula was known to Brahmagupta (*c* A.D. 625).[3] Following this line of thought, the Kerala astronomer Govindasvāmin (*c.* 800-850) has enunciated a set of rules for the computation of intermediary functional values, different formulae being laid down for different augmental intervals :

gacchad-yāta-guṇāntaravapur yātaiṣya-diṣvāsanac-

chedābhyāsa-samūha-kārmukakṛti-prāptat tribhis tāḍitat /

vedaiḥ ṣaḍbhir avāptam antyaguṇāje rāśyoḥ kramād antyabhe

gantavyāhata-vartamāna-guṇajāc cāpāptam ekādibhiḥ //

antyād utkramataḥ krameṇa viṣamaiḥ saṅkhyāviśeṣaiḥ kṣiped

bhaṅktvāptam, yadi maurvikāvidhir ayam makhyāḥ kramād vartate

śodhyam vyutkramatas tathākṛtaphalam...

<div align="right">(Bhāṣya on Mahābhāskarīya, 4.22)[4]</div>

'Multiply the difference of the last and the current sine differences by the two parts of the elemental arc (made by any intermediary point on it) and divide by the square of the elemental arc and further multiply by three. Now divide the result so obtained by four in

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1.   For a demonstration of this formula, see *ibid.*, pp. 13-14.

2.   On the chronology of these works, see *ibid.*, pp. 14-15.

3.   R. C. Gupta, 'Second order interpolation in Indian mathematics upto the fifteenth century,' *Indian Jl. of Hist. of Sc.*, 4 (1969) 86-98.

4.   *Mahābhāskarīya* of Bhāskarācārya, with the *Bhāṣya* of Govindasvāmin and the super-commentary *Siddhāntadīpikā* of Parameśvara, ed. by T.S. Kuppanna Sastri, Madras, 1957, pp. 201-2.

the first *rāśi*, or by six in the second *rāśi*. The final result thus obtained should be added to the portion of the current sine difference (got by linear proportion).

'In the last (third) *rāśi*, multiply the linearly proportional part of the current sine difference by the remaining part of the elemental arc and divide by the elemental arc. Now, divide the result (so obtained) by the odd numbers (1, 3, 5 etc.) according as the current sine difference (is first, second, third etc.), when counted from the end in the reverse order. Add the final result thus obtained to the portion of the current sine difference (got by ordinary proportion). These are the rules for computing true sine differences for (direct) sines. In the case of versed sines, apply the rules in the reverse order and the above corrections are to be subtracted from the respective differences (got by linear interpolation)'.[1]

Using the general functional notation and finite difference operator, the rule for the second *rāśi* may be put as :

$$f(x+nh) = f(x) + n \Delta f(x) + \frac{n(n-1)}{2} \{ \Delta f(x) - \Delta f(x-h) \}$$

which is a particular case (up to the second order) of the general Newton-Gauss interpolation formula.[2]

4. Taylor series for Sine and Cosine functions

The approximations for sine and cosine functions up to the second power of small quantities, following from a well-known series expansion due to the British mathematician Brook Taylor (1685-1731)[3] may be expressed as :

$$f(x+\theta) = f(x) + \theta f'(x) + \frac{\theta^2}{2!} f''(x) \ldots$$

(approximately, when θ is small)

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1. For the rationale of this formula, see R.C. Gupta, *ib.*, pp. 91-92.

2. E. Whittaker and G. Robinson, *Calculus of observations*, London, 1965, p. 37.

3. W.W.R. Ball, *A short account of the history of mathematics*, Dover reprint, New York, 1960, pp. 380-81. But see C. B. Boyer, *History of mathematics*, Wiley, 1968, p. 422.

This approximation has been anticipated, in its particular cases, $f(x)=\sin x$ and $f(x)=\cos x$, by more than three hundred years, by Mādhava of Saṅgamagrāma (c. 1340-1425)[1] in the following verses :

Iṣṭa-doḥkoṭidhanuṣoḥ svasamīpasamīrite |

jye dve sāvayave nyasya kuryād ūnādhikam dhanuḥ ||

dvighna-talliptikāptaikaśaraśailaśikhīndavaḥ |

nyasyācchedāya ca mithas tatsaṁskāravidhitsayā ||

chitvaikām prakṣipej jahyāt taddhanuṣyadhikonāke |

anyasyām atha tām dvighnām tathā 'syām iti saṁskṛtiḥ |

iti te kṛtasaṁskāre svaguṇau dhanuṣas tayoḥ ||[2]

'Placing the (sine and cosine) chords nearest to the arc whose sine and cosine chords are required, get the arc difference to be subtracted or added. For making the correction, 13,751 should be divided by twice the arc difference in minutes and the quotient is to be placed as the divisor. Divide the one, (say sine), by this (divisor) and add to or subtract from the other (*i.e.*, cosine), according as the arc difference is to be added or subtracted. Double this (result) and do as before (*i. e.*, divide by the divisor). Add or subtract the result (so obtained) to or from the first sine or cosine to get the desired sine or cosine chords'.[3]

5. Newton's Power series for the Sine and Cosine

In Western mathematics, Newton (1642-1727) is credited with

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1. On Mādhava, his date and works, see K. V. Sarma, Introduction to his edition of the *Veṇvāroha of Saṅgamagrāma Mādhava*, (Sanskrit College Trippunithura, Kerala, 1965), and his paper on 'The date of Mādhava, a little-known Indian astronomer *Quarterly Jl. of the Mythic Soc.*, **49** (1958) 183-86.

2. Quoted by Nīlakaṇṭha Somayājin in his commentary on the *Āryabhaṭīya* Gaṇita., 12, (edn. Trivandrum, 1930, pp. 54-55), with the prefatory statement : *tatrāha Mādhavaḥ.*

3. For this translation and its rationale in terms of modern mathematics, see R.C. Gupta, 'Second order of interpolation in Indian mathematics up to the fifteenth century', *Indian Jl. of Hist. of Sc.*, 4 (1969) 92-94. For a traditional elucidation, see commentary by Śaṅkara Vāriyar on Nīlakaṇṭha's *Tantra-saṅgraha*, II, 10-13 (edn. Trivandrum, 1953, pp. 19-20) and *Yuktibhāṣā, op. cit.*, pp. 168-71.

the enunciation, in about 1670,[1] of the sine and cosine power series, which might be stated as :

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$$

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \dots$$

These formulae are implied in the following verses of Mādhava, depicting the derivation of the series of sine and tabular versine (*śara*) values of the arc correct to 1/3600 of a degree :

nihatya cāpavargeṇa cāpam tattatphalāni ca |

haret samūlayugvargais trijyāvargahataiḥ kramāt ||

cāpam phalāni cādhodho nyasyoparyupari tyajet |

jīvāptyai, saṅgraho 'syaiva vidvān-ityādinā kṛtaḥ ||

nihatya cāpavargeṇa rūpam tattatphalāni ca |

hared vimūlayugvargais trijyāvargahataiḥ kramāt ||

kintu vyāsadalenaiva dvighnenādyam vibhājyatām |

phalāny adhodhaḥ kramaśo nyasyoparyupari tyajet ||

śarāptyai, saṅgraho 'syaiva stenasirī-tyādinā kṛtaḥ |

'Multiply repeatedly the arc by its square and divide by the square of the even numbers (2, 4 etc.) increased by that number and then multiplied by the square of the radius. Place the arc and the results (of the above operation) one below the other and subtract each from what is above it. (This is the method) to derive the arcs, which are collected (and stated, in order, in the mnemonic verse) beginning with the expression *vidvān* (*i.e.*, 0° 0′ 0″ 44‴ stated in the *kaṭapayādi* notation).

'Multiply repeatedly the unit measurement, (which is the radius), by the square of the arc and divide by the square of the even numbers

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1. Moritz Cantor, *Vorlesungen über Geschichte der Mathematik*, 2nd edn., Vol. III, cited by C.T. Rajagopal and A. Venkataraman in their paper on 'The sine and cosine power series in Hindu mathematics', *Jl. of the Royal As. Soc. of Bengal*, (Science), 15 (1949) 1-13, fn. on p. 1.

(2, 4 etc.) decreased by that number and then multiplied by the square of the radius ; the first is, however, to be divided by twice the radius. Place the results one below the other and subtract each from the one above it. (This is the method) to derive the *śara-s* (tabular versines of the arc) which are collected (and stated, in order in the mnemonic verse) beginning with the expression *stena* (i.e., $0° 0' 0'' 6'''$).[1]

These verses, taken with certain statements occurring in the *Yuktibhāṣā* (pp. 183-90) ard in the *Karaṇapaddhati* (IV. 12-13) lead one directly to Newton's sine and cosine formulae. Though positive proofs are still wanting about the authorship of the above verses which explain the derivation of the sine and *śara* values enumerated in the mnemonical verses beginning with *vidvān* and *stena* which are definitely known to be composed by Mādhava, it is very likely that he himself is the author of these verses also.[2] But whatever that be, since he he has derived the values *vidvān* etc., it but logical to presume that he knew also the method therefor.

6. Infinite G.P. Convergent series

The credit for enunciating in India, for the first time, a formula for the sum of an infinite convergent geometrical progression, goes

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1. For an exposition of these verses and a demonstration of the procedure described, see *Yuktibhāṣā, op. cit.*, Notes on pp. 183-93. See also *Karaṇa-paddhati*, ed. with com. in Malayalam by P. K Koru. (Cherp, Kerala, 1953), pp. 199-207. For a detailed exposition of the rationale of the method, see C.T. Rajagopal and A. Venkataraman, *ibid.* ; T. A. Saraswathi, 'Development of mathematical ideas in India', *Indian Jl. of Hist of Sc.*, 4 (1969) 75-76.

2. While quoting these verses in their Notes, the editors of *Yuktibhāṣā* give the source as *Tantrasaṅgraha*, but without any further reference (see *op. cit.* p. 190), and other scholars have followed this lead (see, e g., C. T. Rajagopal, *ib.*, p. 2). But these verses, as also several others similarly quoted by the editors of the *Yuktibhāṣā*, do not occur in the *Tantrasaṅgraha* (vide edn. of the work, Trivandrum, 1958). T. A. Saraswathi says that "the *Tantrasaṅgraha* published from the Trivandrum University (*sic*) seems to contain one part only of the text. The editors of the *Yuktibhāṣā* had access to the complete MS. in the Trippunithura Skt. College Library, I am informed." (Fn. 9 on p 231 of the *Bul. of the National Inst. of Sc.*, No. 21 (1962). This information is not likely to be correct. The Trivandrum edition of *Tantrasaṅgraha* is, in fact, complete in itself. The second part of the Trippunithura MS. is likely to be another astronomical work written in continuation of *Tantrasaṅgraha*.

to Nīlakaṇṭha Somayāji (born 1444). This he gives in his *Āryabhaṭīya-Bhāṣya*, while explaining the process of deriving the arc of a circle in terms of the chord by means of a computation which involves the summing up of an infinite convergent G.P. series : *evam yas tulyaccheda-paramabhāgā-paramparāyā anantāya api saṁyogaḥ, tasya anantānām api kalpyamānasya yogasya ādyāvayavinaḥ paraspar-aṁsacchedāi ekonacchedāṁśaśādhyam sarvatrāpi samānam eva.* (*Bhāṣya* on *Āryabhaṭīya*, Gaṇita. 17, edn., Trivandrum, 1930, p. 106). 'Thus the sum of an infinite series, whose later terms (after the first) are got by diminishing the preceding one by the same divisor, is always equal to the first term divided by one less than the common mutual divisor.'

In continuation of this enunciation, Nīlakaṇṭha elaborately demonstrates it for a finite G.P. and also for an infinite decreasing G.P.[1]

7. Lhuiler's formula for the Circum-radius of a Cyclic quadrilateral

In Western mathematics, the eighteenth century mathematician Lhuiler is credited with the discovery, in 1782, of an expression for the circum-radius of a cyclic quadrilateral.[2] In India, however, we find the same formula enunciated by the Kerala astronomer Parameśvara (c. 1360-1455) in his commentary on the *Līlāvatī*, in the following lines :

doṣṇām dvayor dvayor ghātayutānām tisṛṇām vadhāt |
ekaikonetarattraikyam catuṣkavdhabhājitam ||

labdhamūlena yadvṛttam viṣkambhārdhena nirmitam |
sarvam caturbhujakṣetram tasminn evāvatiṣṭhate ||

'The three sums of the products of the sides, taken two at a time, are to be multiplied together and divided by the product of the sums of the sides taken three at a time and diminished by the fourth. If a circle is drawn with the square root of this quantity as radius, the whole quadrilateral will be situated inside it.'

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1. On this, see T.C. Saraswathi, 'The development of mathematical series in India', *Bul. National Inst of Sc. of India*, No. 21 (1962) 320 ff. ; see esp. pp. 325-26.

2. *Vide* D.E. Smith, *History of mathematics*, Boston, 1925, vol. II, p. 286.

Thus, if a, b, c, d are the sides and r the circum-radius,

$$r = \sqrt{\frac{(ab+cd)\ (ac+bd)\ (ad+bc)}{(a+b+c-d)(b+c+d-a)(c+d+a-b)(d+a+b-c)}}$$

The rationale of this formula has been given in the 16th cent. Kerala commentary *Kriyākramakarī* on the *Līlāvatī*.[1]

8.　Gregory and Leibnitz's Series for the Inverse tangent

The power series for arc tan x, which was enunciated for the first time in the United Kingdom in 1671 by the Scottish mathematician James Gregory (1638-75) and in Europe in 1673 by the German mathematician and philosopher Gottfried Wilhelm Leibnitz (1646-1716), in the case of $x=1$, may be stated as follows : In the case of infinite series of powers of x representing an arc of a circle of unit radius which subtends at the centre of the circle an angle whose tangent (x) does not exceed unity,

$$\text{arc tan } x = x - \frac{x^3}{3} + \frac{x^5}{5} - \dots (|x| \leqslant 1)$$

In India, this series was enunciated by Mādhava of Sangamagrāma (1350-1410), nearly three centuries before it was discovered in the West. Mādhava's enunciation of the formula is contained in the following lines :

> *iṣṭajyā-trijyayor ghātāt koṭyāptam prathamam phalam |*
>
> *jyāvargam guṇakam kṛtvā koṭivargam ca hārakam ||*
>
> *prathamādiphalebhyo 'tha neyā phalakṛtir muhuḥ |*
>
> *eka-tryādy-ojasankhyābhir bhakteṣv eteṣv anukramāt ||*
>
> *ojānām samyutes tyaktvā yugmayogam dhanur bhavet |*
>
> *doḥ-koṭyor alpam eveha kalpanīyam iha smṛtam |*
>
> *labdhīnām avasānam syān na tathāpi muhuḥ kṛte ||*[2]

'Obtain first the result of multiplying the *jyā* (of a given *dhanus*) by the *trijyā* and dividing the product by the *koṭi* (of the *dhanus*). Multiply

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1. On this, see T.A. Saraswathi, 'Development of mathematical ideas in India', *Indian Jl. of. His. of Sc.*, 4 (1969) 69.

2. Quoted in the Keralite commentary *Kriyākramakarī* on Bhāskara II's *Līlāvatī*, kāṇḍa 2, vṛtta. 40. These lines have been quoted also in the *Yuktibhāṣā* where a geometrical proof for it is given (see *op. cit.*, pp. 113-16).

this result by the square of the *jya* and divide the square by the *koti*. Thus we obtain a second result, (as also) a sequence of the further results by repeatedly multiplying by the square of the *jya* and dividing by the square of the *koti*. Divide the terms of the sequence in order by the odd numbers 1, 3, 5, etc.; after this, add all the odd terms and subtract from them all the even terms (without disturbing the order of the terms). Thus is obtained the *dhanus* whose two elements are the given *jya*. and *koti*. Here, the smaller of the two elements should be taken as the *jya*, since, otherwise, the series obtained will be non-finite (in value).'

According to the above formula, if R is the radius and *s* and *c* are the sine and cosine chords of the arc,

$$\text{the arc} = \frac{sR}{c} - \frac{sR}{3c} \cdot \frac{s^2}{c^2} + \frac{sR}{5c} \cdot \frac{s^4}{c^4} - \ldots$$

which is Gregory's general series for arc tan *x*.

Mādhava's verses quoted above have been extracted and explained in the *Yuktibhāṣā* (*op. cit.*, pp. 113-16) in the traditional manner and its rationale demonstrated in terms of modern mathematics by C.T. Rajagopal and others.[1] Rajagopal's demonstration throws up, *inter alia*, certain interesting anticipations of Kerala mathematicians. Thus, after giving the general derivation of Gregory's series according to the *Yuktibhāṣa* and offering the proof therefor, Rajagopal observes : "There are two points which emerge from a consideration of the mathematical text presented here. In the first place, it employs relations which would appear not to have been noticed in Europe before modern forerunners and followers of the calculus started investigations.........Our second point is not unconnected with the first. The Hindu mathematicians achieved, without the aid of calculus, results which, for us, are treated best by means of the calculus.[2]

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1. C. T. Rajagopal and T V. Vedamurthi Aiyar, 'On the Hindu proof of Gregory's series', *Scripta Math.*, 17 (1951) 65-74 ; K. Mukunda Marar and C.T. Rajagopal, 'On the quadrature of the circle', *Jl. of the Bombay Br. of the RAS* (NS) 20 (1944) 65-82 ; T.A. Saraswathi, 'Development of mathematical series', *ibid.*, 'Development of mathematical ideas', *ibid.*

2. "This is not to gainsay the fact that (i) the Hindus' proof of Gregory's series shows their awareness of the principle of integration as we ordinarily use it nowadays; (ii) their intuitive perception of small quantities like $O(1/n^p)$, $n \to \infty$, in a certain role, is, as good as a practical knowledge of differentiation."

But the Europeans who first explored the possibilities of expressing a circular arc as an infinite series, deliberately employed the calculus to guide them."[1]

9. Leibnitz's Power series for π

In modern mathematics, the irrationality of π was demonstrated, for the first time, by Lambert in a paper read before the Berlin Academy in 1671. It is interesting to note that nearly two centuries prior to this, Nilakaṇtha Somayāji (1444-1545) stressed the same point when he expressed himself in his *Bhasya* on the *Āryabhaṭīya* (Gaṇita. 10) to the effect that it is impossible to measure the circumference of a circle in exact terms of its diameter; it could be stated only approximately (*āsanna*).[2] What is more significant, is that, after elaborating the point further, he quotes anonymously an earlier authority to the same effect, which means that the fact had long been recognised in Indian mathematics.[3]

The enunciation of the value of π as a particular case of the power series for arc tan x, due to Leibnitz (1673), is explicitly :
$$\pi/4 = 1 - 1/3 + 1/5 - \ldots$$

This formula has been anticipated by Mādhava of Saṅgamagrāma (1350-1410) while enunciating a method for the circumference of a circle, in the following verse :

vyāse vāridhi-nihate rūpahṛte vyāsasāgarabhihate |

tri-śarādi-viṣamasaṅkhyā-bhaktam ṛṇam svam pṛthak kramāt kuryāt ||[4]

'Multiply the diameter by 4. Subtract from it and add to it alternately the quotients obtained by dividing four times the diameter to the odd integers 3, 5 etc.'

1. Mukunda Marar and Rajagopal, 'On the Hindu quadrature of the circle', *ibid.,* p. 68.

2. *Cf.: āsannaḥ... kutaḥ punaḥ vāstavīṃ saṅkhyām utsṛjya āsannā eva ihoktā ? ucyate. tasya vaktum aśakyatvāt. kutaḥ? yena mānena mīyamāno vyāso niravayavaḥ syāt, tenaiva mānena mīyamānaḥ paridhiḥ punaḥ sāvayava eva syāt ... niravayavatvam tu na labhyam iti bhāvaḥ.* (edn. Trivandrum 1930, Pt. I, pp. 41-42).

3. *Cf.: ata evāhuḥ—"kṛtakānityavad vyāsa-paridhi niyatau mithaḥ", ibid.,* p. 42.

4. Quoted in the *Kriyākramakarī* (*op. cit.*), with the prefatory statement : *atrāha Mādhavaḥ ... ito'pi laghutaraparidhyānayanopāyaḥ amunaivoktam, yathā,* com. on *Līlāvatī,* kāṇḍa 2, vṛtta., 40).

For a circumference C of a circle of diameter D, this gives the formula : C, (*i.e.*, π D)$=4D-4D/3+4D/5$......or $\pi/4=1+1/3-1/5$......[1]

10. Approximations to the value of π

Continuing his enunciation of the circumference of a circle, as given above, Mādhava goes on to give a rational approximation to its value and, through it, the value of π :

> yatsaṅkhyayī 'tra haraṇe kṛte nivṛttā hṛtis tu jāmitayā |
>
> tasyā ūrdhvagatayās samasaṅkhyā taddalam guṇo 'nte syāt ||
>
> tadvargai rūpahato hāro vyāsābdhighātatah prāgvat |
>
> tasyām āptam svamṛṇe kṛte dhane śodhanāṅ ca karaṇīyam |
>
> sūkṣmaḥ paridhiḥ sā syāt bahukṛtvo haraṇato 'tisūkṣmaś ca ||

'Let the process stop at a certain stage, giving rise to a 'finite sum'. Multiply four times the diameter by half the even integer subsequent to the last odd integer used as divisor and then divide by the square of the integer increased by unity. The result is the correction to be added to or subtracted from our 'finite sum', the choice of addition or subtraction depending on the sign of the last term in the sum. The final result is the circumference determined more accurately than (that obtained) by taking a large number of terms, *i.e.*, terms going beyond the stage at which we stopped.'

The formula enunciated here, which gives the value of π to an advanced degree of accuracy, may be expressed thus :

$$C \doteq 4D \left\{ 1 - \tfrac{1}{3} + \tfrac{1}{5} - \cdots \pm \frac{1}{n} \mp \frac{(n+1)/2}{(n+1)^2+1} \right. \text{where } n \text{ is large.}[2]$$

$$\therefore \frac{\pi}{4} = 1 - \tfrac{1}{3} + \tfrac{1}{5} - \cdots \pm \frac{1}{n} \mp \frac{(n+1)/2}{(n+1)^2+1}$$

1. For a detailed demonstration, see : *Yuktibhāṣā*, op. cit., pp. 99, 11?–13 : C.T. Rajagopal, T.V. Vedamurth. Aiyar, K. Mukunda Marar. *ibid.*, P.K. Koru, *Karaṇapaddhati*, op. cit., pp. 166-67.

2. For a demonstration of this formula; see Rajagopal, Vedamurthi Aiyar, Mukunda Marar, *ibid.*, P.K. Koru, *ibid.*, pp. 176-79 ; *Yuktibhāṣā*, op. cit., pp. 120-23.

A still better correction is suggested by Mādhava in the following lines :

asmāt sūkṣmataro 'nyo vilikhyate kaścanāpi saṁskāraḥ |

ante samasaṅkhyādalavargas saiko guṇaḥ, sa eva punaḥ ||

yugaguṇito rūpayutaḥ samasaṅkhyādalahato bhaved haraḥ |

triśarādiviṣamasaṅkhyāharaṇāt param etad eva vā kāryam ||[1]

'A correction still more precise is being stated here. The multiplier is the square of half the even integer (next greater than the last odd-interger divisor) increased by unity. This multiplier multiplied by 4, then increased by unity, and then multiplied by half the even-integer (already defined), is the divisor. This correction may be applied after the division by the odd integers 3, 5 etc. (indicated in the previous method and the same method of calculation followed).'

This formula which gives a still more accurate value of π may be expressd thus :

$$C \doteq 4D\left\{1-\tfrac{1}{3}+\tfrac{1}{5}-\ldots\pm\frac{1}{n}\mp\frac{\left(\frac{n+1}{2}\right)^2+1}{\left[\left(\frac{n+1}{2}\right)^2\cdot 4+1\right]\left(\frac{n+1}{2}\right)}\right\}$$

$$\frac{\pi}{4}=1-\tfrac{1}{3}+\tfrac{1}{5}-\ldots\pm\frac{1}{n}\mp\frac{\left(\frac{n+1}{2}\right)^2+1}{\left[\left(\frac{n+1}{2}\right)^2\cdot 4+1\right]\left(\frac{n+1}{2}\right)}$$

where n is odd and large.[2]

Elsewhere, Mādhava gives a series for π, different from that of Leibnitz. Thus, in continuation of the formula for the inverse tangent given in the lines *iṣṭajyātrijyayor ghātāt* etc. (see above, p. 20), he mentions the measure of the circumference when the arc calculated is half of circumference. thus :

vyāsavargād ravihatāt padam syāt prathamam phalam |

tadāditas trisaṅkhyāptam phalam syād uttarottaram ||

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1. Quoted in the *Kriyākramakarī* on *Līlāvatī*, kāṇḍa 2, vṛtta., 40.

2. For its demonstration, see *Yuktibhāṣā*, op. cit., pp. 136-39.

rūpādyayugmasaṅkhyabhir hṛteṣv eṣu yathākramam |

viṣamāṇam yutes tyaktvā samam hi paridhir bhavet ||

'Multiply the square of the diameter by 12 and extract the square root of the product. That is the first term. Divide the first term by 3 to obtain the second, the second by 3 to obtain the third and so on and thus get further terms. Divide the terms, in order, by the odd numbers 1, (3, 5) etc. Add the odd-order terms to and subtract the even-order terms from the preceding. The result will give the circumference'.[1]

The above enunciation gives the following formula for the circumference :

$$C \ (i.e., \ \pi D) = \sqrt{12D^2} - \frac{\sqrt{12D^2}}{3\cdot3} + \frac{\sqrt{12D^2}}{5\cdot3^2} - \frac{\sqrt{12D^2}}{7\cdot3^3} \cdots$$

$$= \sqrt{12D}\left\{1 - \frac{1}{3\cdot3} + \frac{1}{5\cdot3^2} - \frac{1}{7\cdot3^3} \cdots\right.$$

$$\pi = \sqrt{12}\left\{1 - \frac{1}{3\cdot3} + \frac{1}{5\cdot3^2} - \frac{1}{7\cdot3^3} \cdots\right.$$

It would be interesting to derive from Mādhava's above-noted value of π, the following relation between circumference and diameter given by him :

vibudha-netra-gaj-āhi-hutāśana-

tri-guṇa-veda-bha-vāraṇa-bāhavāḥ |

nava-nikharva-mite vṛtivistare

paridhi-mānam idaṁ jagadur budhāḥ ||[2]

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1. For an exposition and demonstration of these verses, see *Yuktibhāṣā*, op. cit., pp 114-19 ; Marar and Rajagopal, 'On the Hindu quadrature of the circle', ibid., p. 78 : P.K. Koru, op. cit., pp. 2C3-6.

2. Quoted in the *Kriyākramakarī*, oh *Līlāvatī*, kāṇḍa 2, vṛtta. 40, with the prefatory statement : *Mādhavācāryaḥ punaḥ ato 'pyāsannatamam paridhimānam uktavān.*

That is, for a diameter of 9^{11}, the circumference is 28,27,43,33,88,233. The value of π from this, correct to eleven decimal places, would be 3.14159265359, which accords closely with the modern value of π, which is 3.14159265.

Using the above relationship of the diameter and the circumference, Mādhava has derived the 24 mahajyās (accurate sign-chords) which he has depicted in the mnemonic beginning with *srestham nāma varisthānām* ($0°$—$224'$—$50''$—$22'''$).[1] It has also been verified that the value of the radian assumed by Mādhava in this evaluation corresponds to $3437'$—$44''$—$48'''$—$22'''$, which is remarkably close to its modern approximation, *viz.*, $3437'.74577078 = 3437'$—$44'$—$48''$—$22'''$, 49.[2]

Rajagopal and his colleagues have drawn attention to and demonstrated, in terms of modern mathematics, a large number of further rational approximations of π which are found enunciated in later works like *Yuktibhāṣā, Karaṇapaddhgti* and *Sadratnamālā*,[3] for most of which there are no exact parallels in Western mathematics. These approximations had been obtained by the application of various corrections, presumably in the form of continued fractions, on partial sums of the infinite series for $\pi/4$. Indeed, the enunciation of these corrections speaks volumes about the fervour with which mediaeval mathematicians of Kerala attacked this fascinating problem and the success they achieved therein, some of their enunciations anticipating

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1. For the full enunciation of these *maha-jyās* of Mādhava and their rationale, see *Yuktibhāṣā, op. cit.*, pp 195-98 ; P.K. Koru, *op, cit.*, pp. 203-6.

2. See Rajagopal and Venkataraman, 'The sine and cosine power series in Hindu mathematics', *JRASB* (Sc.), 15 (1949) 3.

3 For these enunciations and their traditional expositions, see : Nīlakaṇṭha Somayāji's *Bhāṣya* on the *Āryabhaṭīya,* Gaṇita. 9-12 (edn., Trivandrum, 1930), Pt. I. pp 40 ff.; *Yuktibhāṣa. op cit.*, pp. 72-142 ; *Kriyākramakarī* on the *Līlāvatī* 2, vṛtta. 40, and *Karaṇapaddhati, op. cit.*, pp. 173-88. And, for their demonstration in modern terms see, Marar and Rajagopal and Vedamurthi Aiyar, 'On the Hindu proof of Gregory's series', *Scr. Math.* 17 (1951) 65-74 ; Rajagopal and Vedamurthi Aiyar, 'A Hindu approximation to Pi', *Scr. Math.* 18 (1952) 25-31 ; T.A. Saraswathi, 'The development of mathematical series in India', *Bul. of the National Inst. of Sc. of India,* 21 (1962) 320-43.

Western discoveries by nearly three hundred years. The same may be said with justification in the case of certain of their other mathematical contributions also. A competent and critical analysis, in terms of modern mathematics, of the writings of Kerala astronomers and mathematicians, the bulk of which still remains locked up in old palmleaf manuscripts, written in Malayalam script, may be expected to throw welcome light on the advances, down the centuries, made in these disciplines, in one remote corner of India.

11. Some other highlights

In the context of the continuity of astronomical tradition and the diligence with which its traditional exponents cultivated its study, a reference might be made here to certain other significant methodologies evolved and discoveries made by Kerala astronomers and mathematicians. The introduction of the *Kaṭapayādi* notation and the expression of astronomical data through mnemonic tables and verses composed with the help of this facile notation has already been noticed. In his table of sine-differences enumerated in the verse *makhi-bhakhi* etc. (*Gītikā* 10), Āryabhaṭa gives only their rough values, correct to the minute. It is interesting that Govindasvāmin (*c.* 800-50) developed their evaluation still more accurately, correct up to the second order of sexagesimal fractions, viz., seconds and thirds, which he gives in his *Bhāṣya* on *Mahābhāskarīya.* He also gives a formula for the derivation of the value of the last sine-difference when the tabular interval is halved. Developing the topic further, he enunciates also a rule for computing, from a given last sine-difference, the other sine-differences lying between 60° and 90°.[1]

The *Kuṭṭakāra-gaṇita,* which is a complex type of calculation involving the Rule of three, Indeterminate equations and Continued fractions, has been developed by Kerala mathematicians to a high degree. It enabled them to solve various problems which require the application of higher algebra according to modern working. Śaṅkaranārāyaṇa (c. 825-900) quotes in his commentary on the *Lahgubhāskarīya* (*op. cit.,* pp. 95-97) a short disquisition on the subject from *Govindakṛti,*

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1. See *Mahābhāskarīya* with Govindasvāmin's *Bhāṣya, op. cit.,* ch 4, verse 22, pp. 201-2. For an exposition of these rules and their rationale, see R.C. Gupta, 'Fractional parts of Āryabhaṭa's sines and certain rules found in Govindasvāmin's *Bhāṣya* on the *Mahālhāskarīya',* *Indian Jl. Hist. of Sc.* 6 (1971) 51-59.

a lost work of Govindasvāmin, while the later works like *Yuktibhaṣā* (16th cent.) give full accounts of the processes involved.[1] Nīlakaṇṭha Somayāji (1444-1545) has made significant contributions including logical proofs and demonstrations to geometrical theorems, a formula for the sum of an infinite, geometrically progressing convergent series, and the rationale for the formula for the sum of a geometrical progression. He has also offered geometrical demonstrations for the sum of an arithmetic progression, the sum of triangular numbers and the sums of squares and cubes of natural numbers.[2]

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1. See *Yuktibhaṣā*, ch. 5, *op. cit.*, pp. 54-71. For the rationale of *Kuṭṭakāra* according to modern mathematical terms, see *ibid.*, Appendix, pp. xli-lxi.

2. See for details, T.C. Saraswathi, 'The development of mathematical series in India', *Bul. of the National Sciences of India*, No. 21 (1962) 320-43.

CHAPTER III

MAJOR TRENDS IN KERALA LITERATURE ON JYOTIṢA

1. Introductory

The extensive Jyotiṣa literature produced in Kerala, in Sanskrit and in Malayalam which latter is the regional language of that part of India, comprise of original treatises, expositions of individual topics, commentaries on standard texts, computation manuals, minor tracts, single verses and manifold mnemonic tables. A good part of the shorter tracts and other secondary literature which do not form full-fledged works have been lost and what survives of this type of literature has to be looked for in flyleaves and end folios of codices where such matter is generally found written. The definitive literature, too, has been affected considerably. The full extent of the literary activity in this line is not adequately known, much less recognised, for reasons of subject, script and language, as already mentioned above. However, an idea of this literary production can be judged from an examination of the surviving literature, a documented Inventory of which is given in Ch. V, below. While the said Inventory is expected to include references to all the works and authors that could be identified, special notice might be taken here of the broad trends and nature of the literature produced in this discipline. In order that the picture of Kerala Jyotiṣa might be presented in full, the accounts given below and in the Inventory are not restricted to astronomy and mathematics but made to include also the allied discipline of astrology which constitutes the applied aspect of astronomy.

2. The Classical texts

Some scholars have claimed that the foremost Indian astronomer, Āryabhaṭa hailed from Kerala. Though this claim yet remains to be fully authenticated, the popularity of the Āryabhaṭīya among Kerala astronomers is apparent from the profusion of manuscripts of that work recorded from that region[1] and from as may as eleven commentaries on it,

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1. Out of about 120 manuscripts of Āryabhaṭīya recorded in the New Catalogus Catalogorum of Sanskrit and allied works and authors, Vol. II, (Madras, 1966), p. 171, as many as 85 are from Kerala.

In Sanskrit and Malayalam, written by Kerala astronomers, the more important among them being those composed by Sūryadeva Yajvan, Parameśvara of Vaṭaśrṇi, Nīlakaṇṭha Somavāji and Ghaṭīgopa.[1] Two other texts of the Āryabhaṭan school, viz., the Laghubhāskarīya and the Mahābhaskarīya of Bhāskara I,—of which, too, most of the recorded manuscripts are from Kerala,—have been equally popular in the land. There are seven Keralite commentaries on the former by Śankaranārāyaṇa, Sūryadeva Yajvan, Parameśvara, Udayadivākara and Śankaran Nampūtiri, the other two being anonymous. The latter work has five Keralite commentaries, including those by Govindasvāmin, Sūryadeva Yajvan and Parameśvara. The other classical astronomical texts which were popular in Kerala are the Sūryasiddhānta which claims three Kerala commentaries and the Laghumānasa of Muñjāla, which has at least four Kerala commentaries. The most popular textbook on mathematics has been the Līlāvatī of Bhāskara II, for which at least a dozen commentaries, besides several other works based on it, have been recorded. On the side of horary astrology, the Horā or Brhajjātaka of Varāhamihira enjoyed the greatest popularity; about twenty commentaries on this work by Kerala authors have been identified; besides these, there are also several abridgements and adaptations of that work. On the same subject, the Jātakakarmapaddhati of Śrīpati, which has three Kerala commentaries, had also been quite popular and in Praśna (Astrological query), the pride of place goes to Praśnaṣatpañcaśikā of Pṛthuyaśas with two Kerala commentaries.

3. Major works on Astronomy

A number of original texts on astronomy, dealing with all the main topics of the subject, have been identified. Some of them, like the Tantrasaṅgraha of Nīlakaṇṭha Somayāji, the Tantrasāra of Nārāyaṇa of Peruvanam and the Sadratnamālā of Śankara-Varman, belong to the tantra type of treatises which take the beginning of the Kali era as the starting point for astronomical calculations. The bulk of the original texts are, however, of the karaṇa type, which use some convenient contemporary date as the epoch for starting the calculations enunciated by them, a device made use of by modern astronomers as well. This date is so chosen that at the ending moment of that day, i.e., at the beginning (sunrise) of the next day, the Mean Moon (Candra) and

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1. For details of the manuscripts, editions, extent, dates, and available studies on these works, as also of other works that might be referred to here-in-below, see Ch. V, 'Inventory of Kerala Jyotiṣa'.

Mean Higher Apsis (*Candra-tuṅga*) are in the same position or very close to each other, so that the days accumulated up to the epoch (called *Khaṇḍa-dina* or *sodhya-dina*) could be subtracted in 'full' from the current *Kali-dina*. The Mean positions of the Sun, Moon and other planets etc. are determined very accurately for the epoch and the readings so obtained are used as zero corrections for all computations for any date after the epoch. The *Grahacāranibandhana* of Haridatta, the basic *karaṇa* text of the *Parahita* system of astronomy, however, uses the date of Āryabhaṭa as the epoch, and the *Dṛgganita* of Parameśvara, the basic text of the *Dṛk* system, uses the beginning of Kali as its epoch. Some of the *karaṇa* texts are mere manuals giving rules for specific astronomical computations while some others like the *Karaṇapaddhati* of Putumana Somayāji, are fullfledged textbocks on the subject. Among the more important *karaṇa* texts may be mentioned the *Karaṇāmṛta* of Citrabhānu, which has three commentaries, the *Karaṇasāra* with commentary, possibly, by Śaṅkara Vāriyar pupil of Nilakaṇtha Somayāji, the anonymous *Karaṇadarpaṇa* with three commentaries, *Karaṇottama* of Acyuta Piṣāraṭi with two commentaries, of which one is by the author himself, the anynomous *Laghukālārpaṇa* and the anonymous *Kriyāsaṅgraha*, with two commentaries. Several *karaṇa* texts have the generic title *Pañcabodha*. A dozen of them have been identified in the Inventory in Ch. V. Most of these are anonymous and only three of the authors could be identified, they being Putumana Somayāji, Puruṣottama and Kṛṣṇadāsa. These *Pañcabodha-s* have been very popular with the almanac-makers of the land and some of these claim commentaries, as well. The *Pañcabodha-s* generally contain five sections dealing with five astronomical topics. The topics treated are not, however, always the same. Thus *Pañcabodha* IV deals with *Vyatīpāta, Chāyā, Mauḍhya, Śṛṅgonnati* and *Grahaṇa*, while *Pañcabodha* II deals with *tithi, Vāra, Nakṣatra, Yoga* and *Karaṇa*. Again, to deal with only five topics is not always the rule in these works ; the number of topics dealt with could be less or more than five. For instance, *Pañcabodha* V or *Pañcabodhaśataka* of Puruṣottama, in 100 verses, contains only two sections and *Pañcabodha* I is in ten sections, dealing with *Tithinakṣatra, Vākyadhruva, Madhyama Sphuṭakriya, Lāṭavaidhṛta, Mauḍhya, Sūryacchāyā, Somacchāyā, Śṛṅgonnati* and *Grahaṇa*. The *Bhadradīpagaṇita* of Iṭakramañceri Nampūtiri and the *Gaṇitasāra* or *Pañcabodha-gaṇitasāra* of Śaṅkaran Nāmpūtiri of Mahiṣamaṅgalam, both in Malayalam, are also comprehensive treatises.

Several of the *karaṇa* texts are smaller tracts devoted only to one or two topics like *Vyatīpāta, Vaidhṛta, Chāyā, Sphuṭakriya* etc.

Three amongst these topics, *viz.*, Computation of the Moon, Eclipses and Shadow, seem to have attracted the special attention of Kerala astronomers and, as a result, a large number of manuals have come to be composed on these subjects. Some of these works attempt also at evolving new processes, offer new corrections and give the rationale to the procedures adopted. Most of these texts are anonymous.

4. Computation of the Moon

The fact that the calculation of the exact *tithi* (lunar day) and *nakṣatra* (asterism) at any moment depends upon the accurate knowledge of the Moon at that moment and that all the three, *viz.*, *tithi*, *nakṣatra* and Moon, are always required for the fixation of social and religious functions, in horoscopy and in the computation of eclipses etc. is enough to explain the importance given to the computation of the Moon. But the fast motion of the Moon, amounting to about 13 degrees a day, and the consequent quick change of its position during the s.me day, required special consideration in its correct computation. A good number of *karaṇa* texts, devoted specifically for the computation of the Moon, have, therefore, been composed. Among the more important manuals of this type may be mentioned the *Candra-sphuṭagaṇita* with a commentary and a super-commentary, *Candra-sūryasphuṭa-gaṇita*, *Candra-sphuṭādi-gaṇita*, *Śuddha-candra-kriyā-gaṇita*, *Śrāddha-candrādi-gaṇita* and *Sūkṣma-candra-sphuṭādi-gaṇita*, all anonymous.

5. Veṇvāroha method for the Moon

Of all heavenly bodies, the Moon has not only the fastest motion, but also the maximum changes in its velocity during the same day. Therefore, the computation of the Moon at some intermediate time during the day, if calculated on the basis of its true position and motion at sunrise or at sunset, as advocated in some *Pañcabodha* texts, would not give accurate results. An ingenious but facile method for the determination of the Moon at any time of the day with high accuracy has been evolved by the 14th century Kerala astronomer Mādhava of Saṅgamagrāma in his work called *Veṇvāroha*. He has also enunciated accurate moon-mnemonics, correct to the seconds, for being used in the *Veṇvāroha* method. His method seems to have caught the fancy also of later astronomers who have extended the method further to yield still more accurate results. At least four later works of this genre have been identified, they being *Candra-*

sphuṭāptī, Veṇvārohakriyā and *Dṛg-Veṇvārohakriyā,* all anonymous, and *Veṇvārohaṣṭaka* of Putumana Somayāji.

6. Computation of Eclipses

A branch of astronomy in which intense investigations have been made by Kerala astronomers refers to the computation of eclipses. The phenomenon of eclipses seems to have been exploited fully towards verifying calculations, instituting corrections and devising new methodologies. A reference has already been made to Parameśvara of *Dṛggaṇita* fame who has recorded the details about a large number of eclipses which he had computed, observed and also suggested corrections to correlate the two. Apart from minor tracts, a number of texts on the computation of eclipses have come down. These include three works having the common title *Uparāgakriyā-krama,* the first by Nārāyaṇa with commentary, the second by Acyuta Piṣārati, with two commentaries, and a third, which is anonymous ; an *Uparāgaviṁśati* with commentary ; *Grahaṇamaṇḍana* by Parameśvara ; six anonymous works with the common title *Grahaṇa-gaṇita* ; four works under the title *Grahaṇāṣṭaka,* one of which is by Parameśvara and the others anonymous ; and the three works, *Candra-graha-gaṇita, Candra-sūryoparāga-gaṇita* and *Sūrya-grahaṇa-gaṇita,* all anonymous. Two works on eclipses which deserve special mention are the *Grahaṇa-nyāya-dīpikā* of Parameśvara, which discusses the rationale of eclipse-computation, and the *Grahaṇa-granthādi* by Nīlakaṇṭha Somayāji, which is an elaborate disquisition on the tradition and rationale of computing eclipses etc.

7. Computation of the Shadow

Computation of the positions of the Sun and the Moon from the Shadow (*Chāya*) caused by them and vice versa had practical utility in the social and religious life of the people of mediaeval times. Besides calculations made on the basis of the *Śaṅku* (gnomon), intrinsic calculations involving the *Mahācchāyā* (Great Shadow or Sine Zenith distance) and the *Mahāśaṅku* (Great gnomon or Sine Altitude) had been developed in this behalf. Some of the *Pañcabodhas* and other *karaṇa* texts mentioned above have sections devoted to Shadow computation. Besides these, several independent works devoted solely to this subject have also been produced. Among the works of this category may be mentioned five different works, all entitled *Candracchāyā-gaṇita,* one of these being by Parameśvara, another by

Nīlakaṇṭha Somayāji and the others anonymous ; two of these works have also commentaries. Other works on the subject include the *Chāyāgaṇita, Chāyāgraha-gaṇita, Chāyādigaṇita* and two different works having the common title *Sūryacchāyādi-gaṇita.* Acyuta Piṣārati, too, has written a succinct work on the subject, entitled *Chāyāṣṭakam.*

8. Long-range almanacs

In the matter of preparing annual almanacs, while the general trend in Kerala, as elsewhere, has been to prepare them for one year at a time, efforts had been made to prepare long-range almanacs covering long periods. It has been recorded that Mādhava of Saṅgamagrāma compiled an *Agaṇita-pañcāṅga*[1] which is, probably, the same as referred to in the *Karaṇapaddhati* (IV. 14, 16, 18) and preserved in the Kerala University Oriental Research Institute under the title *Agaṇitagrahacāra.* Śaṅkaran Nampūtiri of Mahiṣamaṅgalam is credited with a 'Register of Muhūrtas'[2] for 1000 years. The *Agaṇita* of Nalleppaḷḷi Subrahmaṇya Śāstri enunciates methods for the facile computation of the planets for a 1000 years.[3]

9. Astronomical rationale

An extremely significant class of astronomical treatises from Kerala refers to disquisitions on the rationale of astronomical formulae and procedures. Short expositions of this nature occur in commentarial literature, especially in the commentaries of Parameśvara, Nīlakaṇṭha Somayāji and Nārāyaṇa, author of *Kriyākramakarī* on the *Līlāvatī.* Single or groups of verses and short tracts pertaining to the exposition of specific points or procedures are often found inscribed on end-leaves of astronomical codices, without indication of source or author. These go mostly unnoticed or ignored by cataloguers of manuscripts. It would, indeed, be highly worthwhile to record, study and analyse these passages with a view to see if some of them contain anything important. In this connection, the discovery of some full-fledged treatises devoted to the exposition of astronomical

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1. This reference occurs in an astronomical document preserved in the Oriental Institute, Baroda, *Cf.* K. V. Sarma, 'Direct lines of astronomical tradition in Kerala', *Pt. Charudeva Shastri Felicitation Volume,* Delhi, 1972.

2. See Ulloor, *Kerala Sāhitya Charitram,* Vol. II, (Trivandrum, 1954), p. 272.

3. Ref. to by Ulloor, *op.cit.,* Vol. IV, (Trivandrum, 1957), p. 291.

theories and processes ought to be highly interesting to scholars and historians of mathematics. These texts, which, generally, have the words *yukti* or *nyāya* 'rationale' attached to their titles, explain, interpret and discuss the formulae used and procedures followed in the topics which the texts deal with. Among works of this nature may be mentioned the *Grahaṇa-nyāya-dīpikā* on the computation of eclipses and *Vākyakaraṇa* on the formulation of astronomical mnemonics, both by Parameśvara of Vaṭaśreṇi, the *Yukti-bhāṣā* and *Gaṇita-yukti-bhāṣā*, the former and, possibly the latter too, by Jyeṣṭhadeva, the *Nyāya-ratna* by Putumana Somayāji, the *Gaṇita-yuktayaḥ* by an anonymous 'Bhārad-vāja brāhman' and the *Rāśigola-sphuṭānīti* on 'Reduction to the ecliptic' by Acyuta Piṣāraṭi. The *Sundararāja-praśnottara* by Nīlakaṇṭha Somayāji, in which he has explained certain astronomical theories and practices in answer to queries raised by a contemporary astronomer Sundararāja of the Tamil country, also belongs to this category of works. It may also be noted that works solely devoted to the demonstration of procedures call themselves *-kriyā* or *-kriyākrama*, e. g., *Saṅgrahasādhana-'kriyā'* and *Uparāga-'kriyākrama'*.

10. Practical astronomy

Astronomy being a practical science, progress in that discipline is incumbant no less on practical observation than on computational skill. Several works including the *Goladīpikā* I of Parameśvara and the *Bhadra-dīpa* of Iṭakramañceri Nampūtiri contain sections on the construction and use of the armillary sphere. The commentaries of Parameśvara and Nīlakaṇṭha Somayāji carry references to their lifelong astronomical observations. By far the most interesting treatise in this line is the *Grahaparīkṣākrama* of Nīlakaṇṭha Somayāji, in about two hundred verses. There is also a detailed Malayalam commentary on this work. An equally interesting, though possibly, very late, work is *Nazhika-maṇiyute yukti*, in Malayalam, which is a detailed exposition of the working of the pendulum clock.

11. Revision of astronomical constants

As indicated earlier, the composers of *karaṇa* texts generally started their works with contemporary epochs. Sometimes they also started with corrections to the astronomical constants, and to the sine tables which they incorporated in their works. A work mainly devoted to the enunciation of corrected constants is the *Siddhāntadarpaṇa* of Nīlakaṇṭha Somayāji, wherein he has set out the number of revolutions of the planets, and their higher apses, ascending nodes, maximum

latitudes, velocities etc., as investigated and verified by him. He has also written an elaborate commentary on this work. Some short tracts call themselves *Khaṇḍavum dhruvavum* and meie y give the epoch and the corresponding zero-corrections as determined by their respective astronomer-authors. Then again, there e st a large number of manuscripts which form collections of sine tables and mnemonics and are catalogued in libraries under generic titles like *Jyāḥ, Jyotiṣa-vākyāni* etc. on account of their not being full-fledged and independent works. These collections are potential sources of additions and novelties to the well-known mnemonics and, so, deserve to be examined from this point of view.

12. Mathematics

The *Līlāvatī* of Bhāskara II, with more than a dozen Kerala commentaries, has remained, as indicated earlier, the most popular textbook on general mathematics. Among indigenous works, some of the astronomical treatises like *Yuktibhāṣā, Bhadradīpn* etc. deal with general mathematics in some of their sections. An interesting summary of the general mathematical processes is contained in an anonymous work entitled *Ekaviṁśatipraśnakrama.* Other works solely devoted to the treatment of mathematics are *Kaṇakkatikāram,* with commentary, two works having the same title *Kaṇakkusāram,* one in prose and the other in verse, both with commentaries, *Kaṇakkunūl, Kaṇakkucodyam* and *Kaṇakkuśāstram,* all anonymous.

13. Horary astrology

While the classical texts on *Jātakā* used in Kerala were the *Bṛhajjātaka* of Varāhamihira and the *Jātakakarmapaddhati* of Śrīpati, the most popular indigenous text on the subject was the *Jātakapaddhati* of Parameśvara of Vaṭaśreṇi, which has as many as eight commentaries and the *Jātakādeśamārga* of Putumana Somayāji. From among other works, which enjoyed varied popularity, may be mentioned the *Jātaka-krama* and *Jātakasāra* of Śaṅkaran Nampūtiri of Mahiṣamaṅgalam, the *Jātakānītimārga* and *Jātakasārasaṅgraha* by Āzhvāñceri Tamprākkal and the anonymous *Jātakodaya.*

14. Auspicious times (Muhūrta)

Practically all the texts popular in Kerala, enunciating the fixation of auspicious times ·muhūrtas) for the numerous religious and social ceremonies, are of indigenous origin. The *Muhūrtadarśana* of Vidyāmādhava cf Nīlamana near Gokarṇa, with six commentaries, and the *Muhūrtaratna* of Govinda Bhaṭṭatiri of Talakkulam, with its

commentary by Parameśvara of Vaṭaśreṇi, are the early texts of this category. But, by far the most popular works on the subject are two *Muhūrtapadavī-s* written by two brothers of the Māttūr family in Cochin, whose names have, hitherto, remained unknown, but can, now, be identified as Puruṣottama and Subrahmaṇya. The popularity of these two *Muhūrtapadavī-s* can be judged from the profusion of manuscripts of these works available and the seven commentaries composed on them.[1]

15. Astrological query (Praśna)

The branch of astrology called *Praśna* has been very popular in Kerala where many a new technique and practice has been evolved. The classical work on the subject which was popular in the land was the *Praśnaṣatpañcaśikā* of Pṛthuvaśas, son of Varāhamihira, which claims two good Kerala commentaries. There has, however, been substantial literary production, in consonance with the high popularity of its practice. Here too, several treatises comprehending all aspects of *Praśna* and many others which dealt with special items therein have come to be composed. The most important work of the former category is the *Praśnamārga* by a Nampūtiri of the Panakkāṭṭu family, possibly named Parameśvara. Numerous manuscripts of this work and of the four commentaries on it have been recorded. A good number of later works have been based on it or take it as their chief authority. Other full-fledged works on *Praśna* include three treatises with the identical title *Praśnasāra*, one by Śaṅkara, the second by a Somayāji of Bhūtanāthapura and the third by Mādhava of Iñcakkāzhvā family, two works of the name *Praśnānuṣṭhānapaddhati*, both anonymous, *Praśnāmṛta* of Śrīkumāra, *Praśnāyana* of Puruṣottama with auto-commentary, *Praśnamālā*, possibly by Śaṅkaran Nampūtiri of Mahiṣamaṅgalam, with commentary, two works entitled *Praśnariti*, one by Dāmodaran Nampūtiri of Mangalaśśeri and the other by Iṭakkāṭṭu Kūkkaṇiyāl and three different works of the name *Praśnalakṣaṇa*, all anonymous. Among works dealing with individual subjects, there are a large number devoted to topics like *Akṣara, Aṣṭamaṅgala, Āyus, Āyudha, Pakiṭa, Tāmbūla, Roga* etc.

16. Natural astrology

Of classical texts on natural astrology, the *Bṛhatsaṁhitā* of

1. To cite but one instance, the Kerala Oriental Res. Institute and Mss. Library holds in its collections not less than 103 of these manuscripts, as recorded in their catalogues.

Vaiāhamihira was generally known, besides *Lampaka* by Padmanābha, a later work well known in the whole of South India. Among works on natural astrology produced in Kerala, a mention might be made of *Sāmudrikasāra* of Śaṅkara, with two commentaries, two anonymous *Sāmudrikalakṣaṇa-s* and the *Raṇadīpikā* by Kumāra Gaṇaka. The last-mentioned work which, in eight chapters, deals in detail with the preparation for and conduct of war, is particularly significant. Some works deal with individual topics like *Bhūparikṣā*, *Rekhāśāstra* etc. and some others like *Naraceṣṭa, Pakṣiśāstra* etc. with special types of prognostication.

17. Malayalam versions of Sanskrit texts

It is interesting to note that almost all *Jyotiṣa* works in Sanskrit have one or more commentaries or renderings in Malayalam, produced, obviously, with a view to introduce their study among the non-Sanskrit knowing public. This is a feature found in many other regions of India as well. The Malayalam versions are generally called the *Bhāṣā* of the works concerned. Often the author of the original work himself prepared the *Bhāṣā* and at other times, others. There have also been adaptations and abridgements of Sanskrit works. A very instructive instance of this trend is found in the works of an Āzhvāñceri Tamprākkal who, in a series of works, adapted a number of important Sanskrit texts and also provided the Malayalam renderings of these adaptations. Thus, his *Phalasāra-samuccaya*, in three parts, forms, in its Part I called *Jātakabhāga*, an adaptation of the *Horā* of Varāhamihira and the *Sārāvalī* of *Kalyāṇavarman*, in Part II called *Praśnabhāga*, an adaptation of the *Praśnamārga* of Panakkāṭṭu Nampūtiri, and in part III entitled *Muhūrtabhāga*, of the *Muhūrtadarśana* of Vidyāmādhva. In fact, of the ten works credited to this author, five, *viz., Jyotiśśāstrasaṅgraha, Saṅgrahasādhanakriyā, Jātakasārasaṅgraha, Jātakanītimārga* and *Phalasārasamuccaya*, are adaptations of standard Sanskrit works and the other five, form the *Bhāṣā-s* of these five works.

18. Kerala-Jyotiṣa outside Kerala

That some of the characteristic innovations, extensions and practices evolved in Kerala in the discipline of Jyotiṣa, especially in its astrological aspect, have travelled beyond its borders and become current in certain other parts of India is but natural. It is again natural that, as these theories and practices grew popular in those regions, local treatises came to be composed incorporating the new ideas. Most of these treatises are distinguished by the term 'Kerala' tacked

on to their titles.[1] However, what seems highly significant in this matter is the variety and profusion of the works that have been composed in this manner. About 80 works of this nature have been identified in the different Manuscripts Libraries.[2] Their non-Kerala origin has been determined from one or more of the following indications : (1) Clear mention of alien authorship, (2) the addition of the term 'Kerala' to the title, (3) the popularity of the works in other parts of India, while they are virtually unknown in Kerala, (4) the availability of manuscripts of these works only in non-Kerala scripts and (5) the general absence of manuscripts of the works in Kerala. While the bulk of these works are anonymous, some are apocryphal texts attributed to ancient sages or said to be parts of larger *Tantras* and *Samhitas*. Only a few of these are known under the names of their real authors. The disciplines of *Jātaka* and *Praśna* claim the largest number of these works, the former about 20 and the latter about 35.

In horoscopy, some of the works are comprehensive treatises, like for example, *Kerala-rahasya* or *Kerala-jātakānanda* ascribed to Śukrācārya, *Kerala-sūtra* ascribed to Marīci, *Kerala-śāstra-sūtra* or *Jātakālaṅkāra* ascribed to Nikaṣā, and the two anonymous works *Keralīya-jātaka* and *Keralīya-jātaka-saṅgraha*, while the others are devoted to specific aspects of astrology like *bhāva-s*, *daśa-s* and *yoga-s*. An interesting work is *Kerala-horāvyākhyā* by Sarvartupaṇḍita who composed that work at Vijayanagar at the instance of his patron Gopāla.

Most of the texts on *Praśna* are anonymous. Among those whose authors, real or apocryphal, have been indicated are : *Kerala-praśna-grantha* and *Kerala-granthodāharaṇa* both by Mūladeva, *Kerala-śāstra*, *Kerala-praśna* and *Pāśaka-keralī*, all by Garga, *Keralī* by Rāvaṇa, and *Keralīya-praśnaratna* by Nandarāma Paṇḍita. Of peculiar subjects dealt with are prognastication (1) on the basis of letters in the *Akṣaracintāmaṇi* section of *Keralamata* ascribed to Śiva, *Keralapraśna* or *Keralīya-jñāna* and *Akṣarakevalīpraśna*, both anonymous ; (2) on the basis of the throw of the dice in *Kerala-pāśāvalī* of Garga and the two anonymous works *Keralī-praśnavicāra* and *Keralīya-śakunāvalī* ; and

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1. This phenomenon is found, in varying degrees, also in the case of certain other disciplines like Tantra, Śrauta, Dharma and Mantraśāstra.

2. For a classified and documented list of the manuscripts of these non-Kerala works, see Appendix, below.

(3) on the basis of arecanuts in *Keralapraśna* (anonymous, Mithila III. 180). Of works on natural astrology, a mention might be made of *Keralayātrā* on setting out on a journey, and *Keralī* on the throbbing of the limbs and on dreams, both anonymous, and *Keralī-śakuna*, on omens, the last being attributed to Vyāsa.

The desideratum. The non-Kerala works on Kerala Jyotisa, mentioned above, demonstrate how the specialities of a discipline as evolved in one region of India have been transmitted to the other regions of the country and how they have been accepted, preserved and propagated in those parts under the label of their original place of origin. It is well to remember here that it is but natural that during their transmission and propagation through the centuries, some of the original ideas might have undergone some modifications. It is also possible that some new or local ideas have come to be incorporated in these works and paraded as Keralite views. It would be extremely instructive to investigate this subject fully. Comparative studies between the non-Keralite works and allied Keralite works could show how far the former represent the original views. The textual or other sources from Kerala, if any, of the individual non-Keralite works have to be identified. It would also be interesting to examine why these works are almost always unknown in Kerala, the land to which the ideas expressed therein are supposed to belong.

KERALA ASTRONOMERS

1. Introductory

The approach of the Kerala astronomers to the study of that discipline and the broad trends of their writings, as set out in the previous chapters, should form the natural background for an apprisal of the literature produced in the land on astronomy and, for the sake of fullness, also on the allied discipline of astrology. Such an apprisal is attempted in the two chapters that follow. In the present chapter, the major writers are taken note of and in the next chapter is presented a fully documented Inventory of the available literature on these disciplines. It may be noted that the said Inventory carries references to the manuscripts, editions and studies relating to as many as about 600 works on astronomy, astrology and mathematics and details of about 100 authors and authorities.

2. Earlier documentation

Several efforts have been made before to take stock of Hindu astronomical and allied literature, including that of Kerala, though these attempts have hardly succeeded in giving any adequate idea of the extent of the literature produced in Kerala. 'A brief bibliography of Hindu mathematics' by G.R. Kaye[1] records but a single work from Kerala, being the commentary of Paramādiśvara (sic.) on the *Āryabhaṭīya*. The *Gaṇakataraṅgiṇī or Lives of Hindu astronomers* by Sudhakara Dvivedi mentions just four Kerala authors and two works.[2] 'A consolidated list of Hindu mathematical works' by K. Balagangadharan[3] includes just 18 Kerala authors and 42 works. K.K. Raja's well-documented paper on 'Astronomy and mathematics in Kerala : An account of the literature',[4]

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1. *Jl. and Proc. of the Asiatic Soc. of Bengal*, (NS) 7 (1911) 679-86.

2. Rev. edn. by Padmakara Dvivedi, Banares, 1933. The Keralite authorities referred to herein are Parameśvara, Kṛṣṇācārya, Govinda and Vidyāmādhava, among authors, and *Bhaṭadīpikā* and *Daśādhyāyī*, among works.

3. *Mathematics Student*, 15 (1947) 55-70.

4. *Adyar Library Bulletin*, 27 (1963) 118-67.

takes into its purview only some of the more prominent authors in
these two disciplines, numbering about 20, and their works, numbering
about 80. S.N. Sen's *Bibliography of Sanskrit works on astronomy and
mathematics*,[1] carries the documentation of just 13 Kerala authors and
47 works. The major histories of Kerala literature, *viz.*, *Kerala Sahitya
Charitram* (in 5 vols.) by Ulloor S. Parameswara Aiyar,[2] *Keraliya
Samskrita Sahitya Charitram*, (in 6 vols.)[3] and *Kerala Sahitya
Charitram* : *Charcchayum Pūraṇavum*, (in 2 vols.),[4] both by Vaṭakkumkūr
Rajaraja Varma, *Malayala Bhasha Charitram* by P. Govinda Pillai,[5]
and *Kerala Bhasha Sahitya Charitram* (in 7 vols.), by R. Narayana
Panikkar,[6] especially the first three, notice a much larger quantom of the
literature, though they, too, fail to do adequate justice to the subject. In
fact, more than half of the literature on Joytiṣa produced in Kerala does
not find a mention in these volumes. Moreover, the accounts given in
these histories are not documented and are, mostly, distributed in their
different volumes. Neither do these histories, except that of Ulloor,
carry any index to help the reader in locating a work or an author dealt
with therein. Under the circumstances as stated above, the wealth of
material presented, in a chronological manner, in the following pages may
be expected to provide a far more comprehensive account of the
literary output of Kerala in the discipline of Jyotiṣa. It has been
thought not necessary to repeat here the details which are available in the
earlier accounts, but it was felt essential to set out all new information
not noticed in therein. Therefore, in the following pages, the stress will
be on new information, identifications and correlations, although, for
the sake of completeness and continuity, a brief mention will be made
also about currently known authors and works, for further details
about which the earlier writings referred to in the footnotes might be
consulted with advantage. For the documentation of the manuscripts
of the works and for extracts therefrom, the annotated Inventory
in the next chapter might be referred to.

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1. Part I : *Manuscripts, Texts, Translations and Studies*, National Institute
of Sciences of India, New Delhi-1, 1966.

2. Pub., University of Kerala, Trivandrum, 1953-57.

3. Pub., Vol. I, Kamalalaya Book Depot, Trivandrum, M. E. 1113 (A. D.
1938), Vols. II-VI, Mangalodyam, Trichur, M. E. 1122-40 (A.D. 1947-65).

4. Pub., Mangalodayam, Trichur, 1967-69.

5. Reprint, National Book Stall, Kottayam, 1955.

6. Pub., Vidyavilasini Book Depot, Trivandrum, n.d.-1951.

3. Vararuci I (4th cent. A.D.)

Vararuci is the father figure In the astronomical tradition of Kerala. He is supposed to have lived in the first half of the 4th century, this date having been arrived at on the basis of the dates of birth and death of his eldest son Meḷattoḷ Agnihotri, which are given, according to tradition, in the Kali chronograms *yajñasthānam surakṣyam* (12,70,701) and *purudhīḥ samāśryaḥ* (12,57,921) which fall, respectively, in A.D. 343 and 378. The manuscript tradition of the land ascribes to Vararuci the authorship of the 248 *Candra-vākyas* ('moon-sentences'), popularly called *Vararuci-vākyas*, beginning with *gīr naḥ śreyaḥ*, and also the promulgation of the *kaṭapayādi* notation of depicting numbers which has been used in the composition of the said *Vakyas*.[1]

4. Vararuci II

In horary astrology, the work *Kerala-dvādaśabhāvavākyāni*, in 12 chapters, is ascribed to Vararuci ; the manuscripts of the work carry expressive colophons such as *iti Keralīya-Vararuci-vākye* and *Kerala Vararuci-prokta*. Two anonymous works, both entitled *Kerala-dvādaśabhāva-phalam*, one in verse and the other in prose, are allied to Kerala-Vararuci's work mentioned above. Another work of Vararuci is the *Vārarucika*, an extenstive treatise on general astrology In 12 chapters. Still another work called *Vararuci-kerala* called also *Jātakarahasya* and *Kerala-rahasya* on horoscopy is, also, attributed to him. The Vararuci, who is the author of the above works on astrology might be identical, but it is not possible to assert that he is the same as the author of the *Candra-vākyas*.

5. Haridatta (c. 650-700)

Haridatta, as noted earlier, has the distinction of promulgating,

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1. On Vararuci, see Raja, pp. 120-22 ; Ul. vol. I. pp. 77-81, 165 ; Va. vol. I. pp. 90-95. There is another astronomer named Vararuci, the author of the well-known *Vākyakaraṇa* (ed. T. S. K. Sastri and K. V. Sarma, Madras, 1962), which is the source-book of the *Vākya-pañcāṅga*, popular in South India, especially the Tamil region. But this Vararuci, whether the name is real or apocryphal, belonged to the Tamil region, as is clear from the introductory verses of that work. It has also been shown that this is a 13th century work, having been composed between 1282 and 1306, as can be inferred from the *śodhya-dina* ('deductive day') made use of in that work as a 'zero-day' for computations (*vide op. cit.*, Intro., p. ix). For some Keralite legends on Vararuci, see Koṭṭārathil Śaṅkuṇṇi, 'Paṟayiperṟu pantiru kulam' (Mal.), ('The twelve families born of a woman of the Paṟaya caste'), *Aitthyamālā*, (6th edn., Trichur, 1961), pp. 60-90.

In 683, at Tirunāvāy in Kerala, a new system of astronomical computation called *Parahita*, which presented distinct advantages over the prevailing Āryabhaṭan system.[1] One of the important corrections which he introduced was called the *Śakābda-saṁskāra* or *Bhaṭa-saṁskāra*.[2] His *Grahacāranibandhana*, of which and of whose summary critical editions are available,[3] is the working manual of the system. His comprehensive treatise on astronomy entitled *Mahā-mārganibandhana*, referred to in the *Grahacāranibandhana* (III. 44), is yet to be recovered. The well-known verse *vāgbhāvonāt* etc., enunciating his *Śakābda-saṁskāra*, which does not occur in the shorter manual, must be from this treatise ;[4] so also Nīlakaṇṭha Somayāji's quotation in his *Grahaṇādi-grantha* (ms., p. 59) which reads : *atra Haridattaś cāpy āha—'caturdaśabhāgāntaś calanty eva grahās tataḥ'*. The *Parahita* system of computation, which grew highly popular, has played a leading role in the propagation and practice of astronomy in Kerala.[5]

6. Govindasvāmin (*c.* 800-850)

In Govindasvāmin, teacher of Śaṅkaranārāyaṇa (see below) who was the court astronomer of King Ravi Varma Kerala, we have one of the ablest exponents of Bhāskara I and of the Āryabhaṭan system. His elaborate *Bhāṣya* on the *Mahābhāskarīya*[6] contains new ideas and mathematical elaborations which remain to be fully recognised and expounded in terms of modern mathematics.[7] An original work of his on astronomy and mathematics, which is quoted under the title *Govindakṛti* by later writers like Śaṅkaranārāyaṇa, Nīlakaṇṭha

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1. See above, pp. 7-8.

2. On this see above, p. 9.

3. Cr. ed. with Intro., K.V. Sarma, K.S.R. Institute, Madras, 1954.

4. For this verse and its exposition, see above, p. 9.

5. On Haridatta, see : K.V. Sarma, Intro. to his edn. of *Grahacāraniban-dhana, op. cit.,* and 'The original 'text of Parahita-gaṇita', (Mal), *Mathrubhumi Weekly* (Kozhikode), 10.10.1954 ; Raja, 1?3-26.

6. Cr., ed , T. S. Kuppanna Sastri, Madras, 1957.

7. For an exposition of some of these, see R. C. Gupta, 'Second order of interpolation in Indian mathematics', *Indian Jl. of Hist. of Sc.*, 4 (1969) 86-98 ; 'Fractional parts of Āryabhaṭa's sines and certain rules found in Govindasvāmin's *Bhāṣya* on the *Mahābhāskarīya*', *ibid.,* 6 (1971) 51-59.

Somayāji and Nārāyana,[1] is yet to be recovered. So also is his work on astrology which is referred to by Nīlakantha as *Govindapaddhati*.[2] However, manuscripts of his short commentary called *Prakatārtha* or *Sampradāyapradīpikā* on *Parāśarahora* are known but it is yet to be issued in print.[3]

7. Śankaranārāyana (c. 825-900)

Ravi Varma, the 9th century ruler of the Cera dynasty of Kerala had as his chief court astronomer Śankaranārāyana disciple of Govindasvāmin. Śankaranārāyana was a native of Kollapuri on the Arabian coast. The only known work of his is a commentary on the *Laghubhāskarīya* which he wrote in A. D. 869.[4] Besides being highly elucidatory with regard to the subject treated therein, the work throws light on the keen interest evinced by the royalty in the promotion of the study of astronomy, the presence of an astronomical observatory at the capital city Mahodayapuram (modern Kotungalloor near Cochin), the construction of buildings with due reference to mathematical principles, arrangements made in the city for announcing the times of the day—which all point to the conditions that greatly favoured the flowering of astronomical studies in that part of India.[5]

8. Udayadivākara (11th cent.)

Udayadivākara, surnamed Jyotisikabhatta, author of the elaborate commentary called *Sundarī* on the *Laghubhāskarīya*, which takes as its epoch 1073,[6] probably hailed from Kerala. In the *Sundarī* he quotes as many as twenty verses from an unnamed work of a

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1. For instance, see *Śankaranārāyana* in his com. on *Laghubhāskarīya*, TSS, No. 162, pp. 19, 55, 95 ; Nīlakantha, *Grahanādigrantha*, ms., pp. 35, 42, 44.

2 See his *Grahanādigrantha*, ms., p. 44.

3. On Govindasvāmin, see : T.S.K. Sastri, Intro , to his edn. of *Mahābhāskarīya*, op. cit., pp. xlvi-l ; Raja, 127-28 ; Ul. II.96-97. The identification of our author with the 13th cent. Govinda Bhattatiri, au. of *Muhūrtaratna*, made by Ulloor (I.169, II 96, 97) is not correct. Again, Ulloor (I.169) refers to a com. on the *Āryabhatīya* by our author, but no such com. is known.

4. Ed. *Trivandrum Skt. Ser.*, (TSS), No. 162, (Trivandrum, 1949).

5. On Śankaranārāyana, see, Intro. to the above edn., pp. x-xv ; Raja, 128-29 ; Ul. I. 165-67 ; Va. IV, 221-23. Va.'s statement (IV. 222) that *Bṛhatkarmanibandhana* is a work of this author is not correct. *Bṛhatkarmanibandhana* is another name for the *Mahābhāskarīya* of Bhāskara I.

6   Śl. n. 155, as given in his com. on *Laghu.*, II. 29.

mathematician Jayadeva and comments on them.[1] His comments on Jayadeva are quoted also in the *Līlāvatīvyakhyā* (*Kriyākramakarī*) by Nārāyaṇa (Madras Ms. R. 2754, pp. 182, 183-84, 185). Possibly Udayadivākara has commented on Jayadeva's work in full.

9. Acyuta I

An extensive work on analytic astrology, called severally as *Devakerala*,[2] *Keralajyotiṣa*, *Candranāḍī* and *Candrakalānāḍī*, introduces itself as to have been compiled from the teachings of Acyuta, a brahman from Kerala. Acyuta propitiated, by penance, Bṛhaspati, who taught him the *Jātakaskandha*. In a similar manner, Acyuta propitiated Śukra and Parameśvara also and got from them their teachings as well, which he propagated.[3] Neither the date of this Acyuta nor any personal details about him is known. The *Devakerala* which represents his teachings is, obviously, a compilation by his disciples, among whom Veṅkaṭeśa of the Kāśyapagotra is specifically mentioned as the redactor of the *Uttarabhāga* of the work.[4]

10. Keralācārya (? 12th cent.)

According to current tradition, Keralācārya hailed from Trichur in Central Kerala and belonged to the Kāśyapagotra. It is also said that he was a minister of King Rāma Varmā who ruled in Kerala from 1108-32. He wrote on Jyotiṣa, Āyurveda and Tantra. His works on

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1. For a study on these verses, see K. S. Shukla, 'Ācārya Jayadeva, the mathematician', *Gaṇita*, (Bharat Ganita Parishad, Lucknow), 5 (1954) 1-20.

2. Ed. by T. S. Ranganatha Josyar, in 3 parts, *Madras Gov. Or. Ser.*, Madras, 1952-56.

3. Cf. :   *Kerale viṣaye kaścid Acyuto nāma bhūsuraḥ |*
     Bṛhaspatim samuddiśya sa cakre tapa uttamam ||

   prasādasumukhas tasmai prāha devapurohitaḥ |
   tapasā tava tuṣṭo 'smi vatsa kim te karomy aham || ...

   yan mayānukṛtam pūrvam Jātakaskandham uttamam |
   dvisahasreṇa saṅkṣipya tvatkṛte procyate 'dhunā || ...

   Acyuto 'pi punaḥ prītas tapasārādhya Bhārgavam |
   tasmāt sahasrasaṅkhyākam prāptavān Bhārgavam matam || ...

   śiṣyān adhyāpayāmāsa śastram tad Devakeralam | ...

4. Cf. :   *abhivandya mataṅgākhyam śrīmad-veṅkaṭanāyakam |*
     Kāśyapo Veṅkaṭeśo 'ham phalam vakṣyāmi bhūbhujām ||

     (Intro. verse)

Jyotiṣa included *Kerala-saṁhitā*, *Kerala-nāḍigrantha*, *Keralīyaprasna-marga* and *Keralaprasnasāra*. However, as observed earlier, these works must, obviously, be non-Keralite treatises based on Keralite teachings attributed to Keralācārya.[1]

11. Vyāghrapāda

Aṅkaṇaśāstra,[2] called also *Grahasamaya* and *Navagrahasamaya*, has, obviously, been composed by a devotee of god Śiva enshrined at Vaikkom (Skt. Puṇḍarīkapura) in Central Kerala and attributed to sage Vyāghrapāda, the establisher of that place. It is an interesting treatise in analytical astrology, intended as a supplement and corrector to general horoscopic astrology and contains 389 verses, divided into four chapters. Herein, each of the twelve *lagna-rāśis* (ascending zodiacal segments) are divided into nine *aṅkaṇa-s* ('court-yards'), each *aṅkaṇa* being presided over by a planet having individual characteristics. Minute prognostications are made on the basis of the effects of these planets.[3]

12. Kṛṣṇa (c. 1200)

Kṛṣṇa, called also Kṛṣṇācārya, is the author of *Cintājñāna*, a comprehensive work on astrology in thirtytwo chapters. No personal details about him are known but his being quoted frequently as an authority by later writers, the earliest of them being Govinda Bhaṭṭatiri of Talakkuḷam (1237-95), is a pointer to his popularity and his date, which might be taken to be about 1200 or before. He may be identical with Kṛṣṇa, the author of a commentary on the *Horā* of Varahamihira, of which a manuscript has come to light. Kṛṣṇa's *Cintājñāna* has a popular commentary called *Caturasundarī* by Viṣṇu.[4]

13. Kṛṣṇa-śiṣya (c. 1200)

Kṛṣṇa had in one of his disciples, who does not disclose his name or give any other personal details, an ardent admirer and propagator of his teachings. This disciple has composed two works, one a metrical commentary on the *Horā* and the other a short treatise in verse on astrological query, entitled *Prasnaphalaprāptikāla-nirṇaya*. In both these works, he mentions his teacher in high terms

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1. See above, pp. 38-40.

2. Ed. by K. Raghavan Pillai, *TSS*, No. 222, Trivandrum, 1968.

3. On this work, see Intro. to the edn. cited above and Ul. Sup. I. 221-22.

4. On Kṛṣṇa, see Ul. I. 169-70.

and, in the latter, goes to the extent of saying that the minds of those
who have imbibed the teachings of Kṛṣṇācārya would remain unassailed
so far as prognastication is concerned.[1]

14. Sūryadeva Yajvan (1191-c. 1250)

Sūryadeva Yajvan of the Nidhruva gotra and nephew of another
Sūryadeva was a versatile commentator and recognised authority.
He gives his date of birth as 'viśveśa' (1113) śaka in the colophon
to his commentary on the Triprasnādhyāya of the Laghumānasa of
Muñjāla. His elaborate commentaries on the Laghumānasa and the
Āryabhaṭīya are available, but that on the Mahābhāskarīya-bhāṣya of
Govindasvāmin is known only from his reference to it. On astrology,
he commented on the Mahāyātrā of Varāhamihira, and the Jataka-
karmapaddhati of Śrīpati, both of which are popular.[2]

15. Vidyāmādhava

Vidyāmādhava, whose commentary on the Kirātārjunīya, is perhaps,
the best exposition of that mahākāvya, was equally at home in Jyotiṣa.
His Muhūrtadarśana, called also Muhūrtamādhavīya and Vidyāmādhavīya,[3]
is an extensive work in 15 chapters, discussing and prescribing
auspicious times for all types of social and religious functions. He
was a member of the Tuḷu brahman family of Nilamana, his village
being Guṇavatī (Guṇavanta), near Gokarṇa, on the Arabian coast.
He was the son of Nārāyaṇa, an eminent scholar attached to the court
of King Mallappa. The Muhūrtadaraśna has been extremely popular
in Kerala and has six Keralite commentaries on it, two in Sanskrit
and the others in Malayalam.[4]

16. Viṣṇu of Nilamana

Viṣṇu was the son of Vidyāmādhava and had the distinction of
commenting upon his father's Muhūrtadarśana. This commentary,

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1. See the verses extracted in the Inventory, below, under the respective
works.

2. On Sūryadeva, see Raja, 131-32, Sen, p. 124 ; Ul. II. 97-98 ; Ul. Sup.
I. 219 ; Va. I. 390-92.

3. Ed. by Shama Sastry, Vidyāmādhavīyam with Viṣṇuśarma's Muhūrtadīpaka,
Bibl. Sanskrita, Nos. 63, 67, 70, Or. Res. Inst., Mysore, 1923, 1925, 1926.

4. On Vidyāmādhava, see, Ul. II. 95 ; Ul. Sup. I.540 ; Va. I. 441-44.

called *Dīpikā*,[1] is highly elucidatory and informative and has been as much popular in the land as its text.[2]

17. Govinda Bhaṭṭatiri of Talakkuḷam (1237-95)

Govinda Bhaṭṭatiri of Talakkuḷattūr family belonged to the village of Ālattūr in S. Malabar and is renowned as the progenitor of the famous Pāzhūr Kaṇiyār family of astrologers A line of astronomical tradition which he started continued for more than 700 years.[3] The dates of his birth and death are given by tradition by the Kali chronograms *rakṣed govindam arkaḥ* (15,84,362) and *kālindīpriyatuṣṭaḥ* (16,12,691), which fall, respectively, in A. D. 1237 and 1295. His elaborate commentary *Daśadhyāyī* on the *Horā*, called so on account of its commenting only chs. I to X of the work, deals, in substance, with the entire *Horā*.[4] His *Muhūrtaratna* has been very popular. He is said to have written also a *Muhūrtapadavī*, which formed the basis for several later works of that name (Ul. II. 110).[5]

18. Tāmaraṇallūr (14th cent.)

A member of the Tāmaraṇallūr family has produced an authoritative work entitled *Muhūrtavidhi*, called also *Muhūrtam Bhāṣā*. The work is popularly known as *Tāmaraṇallūr Bhāṣā*, after its author. It deals with the fixation of auspicious times for functions and is composed

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1. Ed. with text, *op. cit.*

2. The colophon to the commentary on ch. XI reads :

    Muhūrtādarśanādarśavyākhyāne Viṣṇunā kṛte |

    vyācaṣṭaikādaśādhyāyam Vidyāmādhavanadanaḥ ||

    On the basis of this Ulloor (II. 95) distinguishes between Viṣṇu and Vidyāmādhava's son and states that while the disciple Viṣṇu is the main commentator, ch. XI was commented by Vidyāmādhava's son. But, for the identity of the two, see colophon to the com. on ch. V :

    ittham Vidyāmādhavīye Muhūrtādarśe 'Vidyāmādhavasyātmajena' |

    vyākhyāto 'bhūd gumphite 'Viṣṇunāmnā' vīryāvīryam darśanam pañcamo 'yam ||

3. See above, pp. 5-6.

4. Pub. under the title *Daśādhyāyī*, Venkatesvara Press, Bombay, Saṁ. 1969 (A.D. 1912) ; Vidyakalpataru Press, Palghat, (1905), (in grantha script,.

5. On Govinda Bhaṭṭatiri, see : Raja, 132-33; Ul. I. 167-69, II. 110 ; Va. I. 353-59, II 499-500. For the legends about him see, Koṭṭārathil Śankuṇṇi, 'Talakkuḷattūr Bhaṭṭatiriyum Pāzhūr paṭippurayum' (Mal.), *Aitihyamālā*, I, (6th edn., Trichur, 1961), 99-108.

in early *bhāṣā-miśra* (Skt.-Mal.) verses. The author, who does not reveal his personal name, makes mention of his patron Ceyyūr (?Cellūr) Nārāyaṇan Nampūtiri and might have hailed from Perñcellūr in Malabar.[1]

19. Nityaprakāśa Yati (14th-15th cent.)

Nityaprakāśa Yati cr °Bhaṭṭāraka, about whom the only personal information known is the name of his preceptor, *viz.*, Ānandaprakāśa, has commented on the *Hora*, both in Sanskrit and in Malayalam. Both the commentaries are elaborate and are called *Prakāśikā*. The Sanskrit commentary is called also *Viṣamākṣaravivṛti*. The language of the Malayalam commentary, which is characterised by mediaeval traits,[2] would suggest for it a date in the 14th-15th century.

20. Kumāra Gaṇaka (c. 14th-15th cent.)

Kumāra Gaṇaka is the author of *Raṇadīpikā*,[3] which he composed at the instance of Deva Śarmā, younger brother of Govinda, a Kerala prince, probably of the principality of Cempakaśśeri (modern Ampalappuzha). The work deals with politics, royal conduct and war, on the background of natural and horary astrology. It is divided into eight chapters, called *viveka-s*, devoted, respectively, to *Naya, Yatrā, Jayajaya, Kāla, Sūlacakrādi, Pañcasvara, Mṛgavīrya* and *Bhūbala*. The author writes very readable poetry and reveals a liberal and progressive bent of mind.[4]

21. Rudra I (c. 1325-1400)

Parameśvara Vaṭaśreṇi (1360-1455), of *Dṛggaṇita* fame, has mentioned in several of his works, Rudra, the eminent astronomical authority at whose feet he learnt the disciplne. This Rudra's has, however, not been identified as the author of any work.[5]

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1. On Tāmaranallūr, see Ul. I. 430-1 ; Ul. Sup. I 146 ; Va. III 396. Two manuscripts of the work, Ker. 4147-A and PM 4113-B, call themselves *Muhūrtapadavī Bhāṣā*. It remains to be seen whether it is related to the *Muhūrtapadavī* of Govinda Bhaṭṭatiri of Talakkuḷam.

2. *E. g.*, see the lines : *yāvad gataḥ śītakaro* etc. (*Hora* 24. 6) : *enpatu praśnam peṇṇina pozhutu praśnarāśikku ettanayām rāśiyile candran ninrān enru inta candran ninra rāśi piṭittu akkaṇṇakkeṇṇi avvirāśiyile candran nilkarpirantān enru colluka* / (*Des. Cata. of Skt. Mss. in H H. the Maharaja's Palace Library, Trivandrum*, Ms. No. 995, (vol. IV, p. 1315).

3. Ed. *TSS*, No. 95, Trivandrum, 1923.

4. On Kumāra Gaṇaka, see Ul. II. 112-13 ; Va. II. 7.5-29

5. On Rudra, see Raja, 138.

22. Mādhava of Saṅgamagrāma (c. 1340-1425) : Mādhava I

Mādhava, referred to by later astronomers as *Golavid* ('Master of spherics'), was an astute mathematician who belonged to Saṅgama-grāma, identified with Irinjālakkuḍa, near Cochin. According to an old astronomical document, he belonged to the sub-caste of Kerala brāhmans called Emprān-s and the name of his house was Ilaññippaḷḷi.[1] In his *Veṅvāroha*,[2] he evolved a facile procedure to read out the true positions of the Moon every 36 minutes.[3] He uses, in this work, a date in A. D. 1400 as the epoch, which gives a clue to his date. Among his known works are *Lagnaprakaraṇa* and a table of moon-mnemonics correct to the seconds. His *Mahājyānayanaprakāra* and *Madhyamānayanaprakāra*, for which short commentaries are available, contain novel theorems and computational methods evolved by him and used by later writers.

An important work of Mādhava, which may be identified here, is his *Agaṇita*. The astronomical document mentioned above states that Mādhava is the author also of an *Agaṇitapañcāṅga*. An anony-mous *Agaṇitagrahacāra* which has been quoted by *Karaṇapaddhati* (IV. 14, 16, 18) and is available in manuscript form mentions the *śodhyābdas* ('deductive years') for the computation of Mars, Mercury, Jupiter, Venus, Saturn and Moon's Higher Apsis as Śaka 1320, 1318, 1340, 1158, 1301 and 1276, corresponding to A.D. 1398, 1396, 1418, 1236, 1379 and 1354.[4] Since the principle underlying the *sodhyabdas* is to fix them in such a way that the largest possible number of

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1. Cf. the words : *Māthavan Veṇvārohādīnām karttā. ... Mādhavan Ilaññippaḷḷi Emprān,* in a Kerala manuscript, No. 9886, preserved in the Oriental Institute, Baroda, and ed. by K. V. Sarma in the paper 'Some direct lines of astronomical tradition in Kerala', Pt. Charudeva Shastri Felicitation Vol., Delhi, 1972.

2. Cr. ed. by K. V. Sarma, with the commentary of Acyuta Piṣaraṭi, Sanskrit College, Trippunithura, 1956.

3. For a note on other works of this genre, see above, pp. 32-33.

4. Cf. Ms. T. 280, *Cata. of the Skt. Mss. in the Curator's Office, Trivandrum.* Vol. IV, p. 1305 :

śakābdāt 'naraloko'nād rāghavair dhītsunā kujaḥ /
'divyaloko'-nanīlāgrais tattvajñair bhājite budhaḥ //

'navaloko'-nasāraṅgair gajair āpte gurur bhavet /
'hemapuṇyo'-naśakābdāt sāravair govarair bhṛguḥ //

'yajñaloko'-nanītaṁśair dharmair āpte śanir bhavet /
'tīrthapriyo'na-śakābdād gandhajñair bhājite tamaḥ //

years will be cut off from the number of the current year, thereby providing maximum ease in calculation, the *śodhyābdas* selected would be as near as possible to the date of the composition of a work, which date would, naturally, be just ahead of the largest *śodhya*. In the case of the *Agaṇitagrahacāra* in question, the *śodhyābdas*, with A. D. 1418 as the latest among them, agrees, surprisingly, with the date of Mādhava. This goes to confirm that in the present *Agaṇitagraha-cāra* we have a hitherto unidentified work of Mādhava, *viz.* his *Agaṇitapancāṅga* which is mentioned in the said astronomical document. Again, it seems quite possible that Mādhava had composed a comprehensive treatise on astronomy and mathematics, which yet remains to be identified and which may be supposed to contain the numerous single and groups of verses enunciating computational procedures, theorems and formulae which are quoted as Mādhava's by later writers. Possibly, Mādhava wrote also a work named *Golavāda*[1] which gained for him the appellation *Golavid* by later scholars.[2]

23. Parameśvara of Vaṭaśreṇi (*c.* 1360-1455) : Parameśvara I

Parameśvara, one of the foremost astronomers of Kerala who revised the *Parahita* system of computation through his *Dṛggaṇita* in 1430, has made significant contributions to Hindu mathematics and astronomy. He was a Ṛgvedin of the Āśvalāyana-sūtra and the Bhṛgu-gotra. He hailed from the village of Aśvatthagrāma (Mal. Ālattūr) and his house Vaṭaśreṇi (Mal. Vaṭaśśeri) was situated on the confluence of river Nīlā (Mal. Bhāratappuzha) with the Arabian Sea, where, on the sandy expanse, he carried on investigations for fiftyfive years. He also observed a large number of eclipses, of which he has recorded the details in his *Siddhāntadīpikā*.[3] His grandfather was a disciple of

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1. A matter of melancholy interest might be mentioned here, at least for record. The presence of a work entitled *Golavāda* written in continuation of Mādhava's *Veṇvāroha* in a manuscript preserved in the Eḷankunnappuzha Naṭakkal Kovilakam, near Ernakulam, raised in the present writer the hope that that could, possibly, be a thitherto unknown work of Mādhava. When, however, he proceeded to the said Kovilakam and, with a good deal of persuasion, caused the wooden box containing the family collection of manuscripts to be opened, he found that all the manuscripts in that box, including that of *Golavāda*, had been completely eaten away by white ants. For further details, see his note on the subject in the *Mathrubhumi W*, (Kozhikode), 17.6.1956, p. 4.

2. On Mādhava, see : K. V. Sarma, Intro. to the edn. of *Veṇvāroha*, *op. cit.*; 'Saṅgamagrāma Mādhava', (Mal.), *Mathrubhumi W*, 4. 11. 1956, pp. 17-18, 59; Raja. 133-36; Ul. II. 91-100; Va. I. 387-88, III. 388-90.

3. On Parameśvara's extensive astronomical observations, see above, pp. 2-4.

Govinda Bhaṭṭatiri of Talakkuḷam and he himself was a pupil of Rudra I, Nārāyaṇa son of Parameśvara and Mādhava of Saṅgamagrāma.

Parameśvara was a prolific wri'er, author of about 30 works, including original treatises and commentaries, both on astronomy and astrology. Among his original writings on astronomy might be mentioned the *Dṛgganita* ('430),[1] three works on spherics, being the *Goladīpikās* I-III (144³),[2] three works on improved computation and rationale of eclipses, viz., *Grahaṇāṣṭaka*,[3] *Grahaṇamaṇḍana*[4] and *Grahaṇanyāyadīpikā*,[5] a text on the computation of the Moon-shadow, entitled *Candracchāyāganita* and a rationale on the computation of mnemonic tables, *Vākyakaraṇa*.[6] He has commented on the *Aryabhaṭīya*,[7] *Mahābhāskarīya*,[8] *Mahābhāskarīya-bhāṣya*,[9] *Laghubhāskarīya*,[10] *Sūryasiddhānta*, *Laghumānasa*[11] *Līlāvatī*, *Goladīpikā* I[12] and *Vyatīpātāṣṭaka*. Some of his commentaries, like, for instance, those on the *Aryabhaṭīya* and *Mahābhāskarīya-bhāṣya*, are extremely valuable for the historian of Hindu astronomy, since they contain the enunciation of some of his new findings, theories and interpretations. Two of his works on astronomy, viz., *Vākyadīpika* and *Bhādīpikā*, are yet to be recovered. His writings on astrology include *Acārasaṅgraha* in two versions, one of them ending with *Vivāhānukūlyam*, *Jātakapaddhati*, and *Ṣaḍvargaphalam* and commentaries on the *Jātakakarmapaddhati* of

1. Cr. ed., K.V. Sarma, V.V.R.I., Hoshiarpur, 1963

2. I: Cr. ed., K.V. Sarma, Adyar Library, Madras, 1957 ; II : Ed. T. Ganapati Sastri, TSS, No. 49, Trivandrum, 1916. The traditional date of composition of one the *Goladīpikās* (which one it is not possible to say) is given by the chronogram *diyatām* (M.E. 618) equivalent to A.D. 1443, is given by Achyutattu Vasudevan Moossatu in his collection of chronograms entitled *Maṟakkatta nalukal* ('Unforgettable days'), Kunnamkulam, M.E. 1130 (A.D. 1955).

3. Cr. ed., K.V. Sarma, K S R. Inst., Madras, 1959.

4. Cr. ed., K.V. Sarma, V.V.R.I., Hoshiarpur, 1965.

5. Cr. ed., K.V. Sarma, V.V.R.I., Hoshiarpur, 1966.

6. This *Vākyakaraṇa*, in about 75 verses, is different from the *Vākyakaraṇa* attributed to Vararuci III.

7. Ed., H. Kern, Leiden, 1874 ; Udaya Narain Singh, Etawah, 1906.

8. Pub, *Anandasrama Skt. Ser*, No. 126, Poona, 1945.

9. Cr. ed., T.S. Kuppanna Sastri, Gov. Or. Mss. Lib. Madras, 1957.

10. Pub., *Anandasrama Skt. Ser.*, No, 128, Poona, 1916.

11. Pub., *Anandasrama Skt. Ser.*, No, 123, Poona, 1944.

12. Cr. ed:, K.V. Sarma, Adyar Library, Madras, 1957.

Śrīpati, *Praśnaṣaṭpañcāśikā* of Pṛthuyaśas, an anonymous *Muhūrtaṣṭāka* and the *Muhūrtaratna* of Govinda Bhaṭṭatiri.[1]

24. Dāmodara of Vaṭaśreṇi (*c.* 1410-1510) : Dāmodara I

Of Dāmodara, son of Parameśvara of Vaṭaśreṇi, no fullfledged work is known, but his pupil Nīlakaṇṭha Somayāji refers to him as an erudite astronomer and quotes from his writings. Thus, in his *Bhāṣya* on *Āryabhaṭīya* (*Kālakriya* 17-21), Nīlakaṇṭha says : *tac coktam asmad Ācāryaiḥ* : *sarvatra viṣkambhadalam śrutau vā vyāsārdhake syāt viparītakarṇaḥ* / (Edn., *TSS*, No. 110, p. 47). Further down, in the same context, Nīlakaṇṭha quotes a longer piece with the introductory statement : *nibaddham ca tat tadaiva asmadgurubhiḥ pañcabhir upajātibhiḥ* :

> *arkasphuṭenānayanam   prakuryāt*
> *svamadhyamasyātra vituṅgabhānoḥ* |
> *bhujāguṇam   koṭiguṇam   ca   kṛtvā*
> *mṛgādikendre 'ntyaphylākhyakoṭyoḥ* ||

> *bhedaḥ [kulīrādigāte   tu   yogas*
> *tadvargayuktād bhujavargato yat* |
> *padam viparyāsakṛtaḥ sa   karṇas*
> *trijyākṛtes tadvihṛtas tu karṇaḥ* ||

> *tenāhatām   uccavihīnabhānor*
> *jīvām bhajed vyāsadalena labdham* |
> *svocce kṣipec cāpi tam   ādyapāde*
> *cakrārdhataḥ śuddham api dvitīye* ||

> *cakrārdhayuktam   tu   tṛtīyapāde*
> *saṁśodhitam maṇḍalatás caturthe* |
> *evamkṛtaḥ sūkṣmataras tu madhyaḥ*
> *pūrvam padam yāvad ihādhikam syāt* |

1. On Paramesvara, see : K.V. Sarma, Intro. to his edns. of Parameśvara's works, *op. cit.* ; '*Dṛgaṇita* of Parameśvara', (Mal.), *Mathrubhumi W*, 7.10.1956, pp. 29-30; 'Fiftyone years' penance' (Mal.), *Mathrubhumi W* , 7.10.1956, pp. 29-30 ; Raja, 136-43 ; Sen, pp. 166-70 ; Ul. II. 100-5 ; Ul Sup., I. 215-19 ; Va. I. 378-83.

antyāt phalāt koṭiguṇaś caturthe
tv ārabhyate yady adhikātra koṭiḥ |
sarvatra viṣkambhādalam śrutau vā
vyāsārdhake syād viparītakarṇaḥ ||

(*Ibid.*, p. 48)

Elsewhere, too, Nilakaṇṭha quotes Dāmodara : *E.g.*, *prakārāntareṇa* *'candrabāhuphala' ityādinā śrīmad-Dāmodarāhvayāsmadgurumukhod-gatena ślokenoktā |* (*Grahaṇādigrantha*, ms., p. 61). Later writers also mention Dāmodara. Dāmodara might have composed certain works which are yet to be identified, and from which the above-mentioned passages should have been quoted.[1]

25. Ravi Nampūtiri (c. 1425-1500)

Nilakaṇṭha Somayāji (1444-1545) mentions in the colophon to his *Āryabhaṭīya-bhāṣya*, *Gaṇitapāda*, Ravi as his teacher on Vedānta. He pays his respects to Ravi also in the beginning of his *Siddhāntadarpaṇa*. Ravi was also an erudite scholar in Jyotiṣa and has been identified as the author of *Ācāradīpikā*, an elaborate metrical commentary on the *Muhūrtadīpikā*.[2]

26. Nilakaṇṭha Somayāji (1444-1545) : Nilakaṇṭha I

Nilakaṇṭha Somayāji, the centenarian astronomer of Kuṇḍapura (Mal. Tṛkkaṇṭiyūr) in South Malabar, was, perhaps, as eminent as his grand-teacher, Parameśvara of Vaṭaśreṇi. In a detailed colophon to his *Bhāṣya* on the *Āryabhaṭīya*, *Gaṇitapāda*, he gives full details about himself. Elsewhere also, in his works, he records particulars about his person. He was a Numpūtiri of the Garga-gotra and hailed from the family of Keḷallūr (Mal. Kerala-nal-ūr, Skt. Kerala-sadgrāma). He was the son of Jātavedas and had a younger brother named Śaṅkara. His date of birth is given in the chronogram given in his *Siddhānta-darpaṇa-vyākhyā*, v.z., *tyajāmyajñatām tarkaiḥ* (16,60,181) which falls in Dec. 1444. He is referred to as a 'living' authority by Mādhava of Iñcakkazhvā in his *Praśnasāra*, composed in 1542-43. Both he and his brother Śaṅkara were patronised by Kauṣītaki Āḍhya

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1. On Dāmodara, see Ul. Sup. I. 210-11 ; Va. I. 388. Va. identifies (I. 388) the present author with Dāmodara, au. of *Muhūrtābharaṇa*, but this is not possible, for the former belonged to the Bhārgava-gotra while the latter was of the Bhāradvāja-gotra ; cf. the Intro. verse to *Muhūrtābharaṇa* (Ms. Kerala T. 71) : *teṣām viduṣām madhye Bhāradvājagotrajātā ye |*

2. On Ravi, see K.V. Sarma, Intro. to the edn. of *Golasāra*, p. xv ; Ul. II. 113-14.

Netranārāyaṇa (Āzhvāñceri Tamprākkal), the hereditary religious head of the Nampūtiris. Nīlakaṇṭha spent his student days at the house of Parameśvara of Vaṭaśreṇi and received occasional instruction from him, his regular teacher being Parameśvara's son, Dāmodara. Nīlakaṇṭha had also another teacher by name Ravi, who is identified as the author of *Ācāradarśana*.

Nīlakaṇṭha was a versatile scholar, though his writings, which are prolific and erudite, are all on astronomy. His *Tantrasaṅgraha* (A.D. 1500)[1] is a comprehensive treatise on astronomy. His *Grahaṇanirṇaya* and *Candracchāyāgaṇita*, the latter with his own commentary, deal with revised procedures on the respective topics. In his *Golasāra*[2] he gives a résumé of some of his views on certain astronomical topics and in his *Siddhāntadarpaṇa*,[3] he sets out the astronomical constants, as determined by him, the rationale of which he expounds in his commentary on that work. In some elaborate tracts on eclipses and certain other topics (*Grahaṇādigrantha*) he expounds the tradition and rationale of eclipse computation, methods for determining corrections (*saṃskāra-s*) etc. His *Sundararājapraśnottara* forms his answers to certain astronomical problems posed by a contemporary astronomer from the adjoining Tamil region who has commented on the *Vākyakaraṇa* ascribed to Vararuci.[4] Nīlakaṇṭha sets out much original contribution through his extensive *Bhāṣya* on the *Āryabhaṭīya*[5] which is considered to be his masterpiece. But, by far the most instructive work of Nīlakaṇṭha is the *Grahaparīkṣākrama*,[6] where, in about 200 verses, he sets out the procedures for the observation of the planets, sometimes with instruments, and for their computation using the data

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1. Ed. with the commentary of Śaṅkara Vāriyar, *TSS*, No. 185 (Trivandrum, 1958).

2. Cr. ed., K.V. Sarma, V.V.R.I., (Hoshiarpur, 1970).

3. Cr. ed., K.V. Sarma, Adyar Library, (Adyar Library, Madras, 1955).

4. Cr. ed., T.S.K. Sastri and K.V. Sarma, K.S.R. Inst., Madras, 1962.

5. Ed. *TSS*, Nos. 101, 110, 185, (Trivandrum, 1930, 1931, 1957).

6. This work has been quoted in full in his *Āryabhaṭīya-bhāṣya*, *Gola*. 48, (*TSS*, No. 185, pp. 132-49). An adapted edition of this has been issued by Puliyur Purushottaman Namputiri, (Bombay, 1950). A perfect ms. of the work is available with K.V. Sarma.

obtained from the observations. A commentary in Malayalam expounding the said procedures is also known.[1]

27. Śaṅkara of Keḷallūr (c. 1475-1575) : Śaṅkara I

Nīlakaṇṭha Somayāji's younger brother Śaṅkara, an astronomer in his own right, was, like his brother, patronised by the Azhvāñceri Tamprakkaḷ, at whose house he was teaching astronomy as mentioned in Nīlakaṇṭha's *Āryabhaṭīya-bhāṣya, Gaṇita.* 26, (edn., p. 156). The said *Bhāṣya* had been composed for the sake of Śaṅkara, who was also entrusted with its propagation.[2]

28. Citrabhānu (c. 1475-1550)

Citrabhānu Nampūtiri, author of *Karaṇāmṛta*, an advanced manual on astronomical computation in four chapters, was a pupil of Nīlakaṇṭha Somayāji, whom he mentions as 'Gārgya' in the beginning of his work. He belonged to the Gautama-gotra and hailed from the village of Covvaram (Skt. Śivapuram) near Trichur. The date of composition of *Karaṇāmṛta* which is indicated in that work by the Kali chronogram *buddhyonmathyoddhṛtam yatnat* (16,91,513) (A.D. 1530) gives the clue to its author's date.[3]

29. Citrabhānu-Śiṣya (c. 1500-75)

Bhāvacintāvali, in three chapters, is a work on astrology by an anonymous pupil of Citrabhānu. That the pupil has written on astrology would suggest that the teacher Citrabhānu, besides being an astronomer, was also an authority on astrology.[4]

30. Nārāyaṇa I (c. 1500-75)

Nārāyaṇa, disciple of another Nārāyaṇa and Citrabhānu, ardent admirer of Nīlakaṇṭha Somayāji and highly devoted to Subrahmaṇya,

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1. On Nīlakaṇṭha, see : K.V. Sarma, 'Gārgya Kerala Nīlakaṇṭha Somayājin', *Jl. of Or. Res.,* 26 (1956-57) 24-39 ; Intro. to the edns. of *Siddhāntadarpaṇa* and *Golasāra,* op. cit., ; Raja, 143-52 ; Sen, 155-57 ; Ul. II. 117-20 ; Ul. Sup. I. 235-37 ; Va. I. 3.3-87.

2. On Śaṅkara, see K V. Sarma, Intro. to *Golasāra,* op. cit., p. xiii.

3. On Citrabhānu, see Raja, 153-55 ; Ul. II. 273-75 ; Ul. Sup. I. 305-6.

4. On Citrabhānu-Śiṣya, see Raja, 154 (where the work is wrongly called *Bhāvacintāmaṇi*) ; Ul. II.275.

an esteemed associate of Nīlakaṇṭha, was an original thinker and highly informed commentator. He wrote, in A.D. 1529, an instructive commentary called *Laghuvivṛti* on *Pañcabodha IV*.[1] His *Uparāga-kriyākrama* in five chapters is a detailed exposition of eclipse computation. He also wrote two commentaries on the *Līlāvatī*, one short and the other nearly five times as long, both called *Kriyākramakarī* and *Karmadīpikā* (called also *Karmapradīpa* and *Karmapradīpikā* according to the exigencies of the metre of the verses containing these names).[2] The longer *Kriyākramakarī* is especially valuable to the historian of Kerala astronomy and mathematics for the profuse references it contains to earlier authors and authorities, some of which are now lost, and for the theories and procedures enunciated in that commentary.[3]

31. Saṅkara Vāriyar (c. 1500-60) : Saṅkara II

The author of *Laghuvivṛti* (A. D. 1556), which is an erudite commentary on the *Tantrasaṅgraha*, was a disciple of Nīlakaṇṭha Somayāji and protege of (Netra) Nārāyaṇa (Āzhvāñceri Tamprākkaḷ), both of whom are mentioned in the beginning of that commentary, is identified with Śaṅkara Vāriyar of Tṛkkuṭaveli family. Though the name of the author is not mentioned in the commentary itself, some manuscripts of that commentary (Kerala Univ. 8351, 8906, C. 524) carry the following post-colophonic statement, in Malayalam, by the scribe : *ī vyākhyānam Tṛkkuṭaveli-c-Caṅkaravāriyar oṭukkaṭṭu camaccatu | Āzhvāñcerikku veṇṭiṭṭu sukhame śikṣiccu camacu ennu Paraññoṭṭu paraññu keṭṭu* | : 'This commentary was composed last by Tṛkkuṭaveli Śaṅkara Vāriyar. It is stated to have been said by Paraññoṭṭu that it was composed with great care for the sake of Āzhvāñceri'. The person referred to here as Paraññoṭṭu is very likely to be Paraññoṭṭu

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1. *Cf.* the chronograpm *prajñālokoddhṛtam yas* (Kali day 16,91,302) in the verse at the end of this work :

> *prajñālokoddhṛtam yasmāt gūḍham artham vivṛṇvatī |*
> *vyākhyaivam Pañcabodhasya ciram tiṣṭhatu bhūtale ||*

2. Some scholars distinguish between the authors of the two commentaries on the *Līlāvatī* and suggest that Śaṅkara Vāriyar of Tṛkkuṭaveli might have written the longer *Kriyākramakarī* (*cf.* Raja, 155) ; again, some miss to recognize 'two' *Kriyākramakarī-s* (Ulloor II, 12ı). The matter has been examined in detail and the authorship of Nārāyaṇa of both the commentaries is being set out by the present writer, elsewhere.

3. Oꟼ Nārāyaṇa, see Ul. II. 121 ; Ul. Sup. I. 222, 227-28.

Jyeṣṭhadeva, an younger contemporary of Nīlakaṇṭha, and, therefore, the statement is quite likely to be authentic.

Hitherto, Śaṅkara Vāriyar has been credited with the authorship only of the above-said commentary. However, three more of his works can now be identified. Thus, in the beginning of the present commentary, he makes mention of a larger commentary of his on Tantrasaṅgraha :

> Nārayaṇām jagadanugrahajāgarūkam
>
> Śrī-Nīlakaṇṭham api sarvavidam praṇamya |
>
> yat Tantrasaṅgraha-gatam grahatantrajātam
>
> tasyā'parām' ca Vivṛtim vilikhāmi Laghvīm ||

Again, in the final colophon at the end of the work, he states that the present commentary is an adaptation of a larger commentary of his named Kriyākalāpa ('Detailed demonstration') on the Tantrasaṅgraha. Cf. :

> iti Tantrasaṅgrahasya Kriyākalāpam'krameṇa saṅgṛhya |
>
> racite tadvyākhyāne pūrṇo 'bhūd aṣṭamo 'dhyāyaḥ ||

A unique manuscript of this longer commentary has been recorded in the Inventory below. It can also be shown that the anonymous work entitled Karaṇasāra, in four chapters, whose authorship has been left open (cf., Ul. II. 121-22) and a Malayalam commentary on it which is, at present, attributed to Śaṅkaran Nampūtiri of Mahiṣa-maṅgalam (Ul. II. 272, 474), are really the works of Śaṅkara Vāriyar.[1]

32. Jyeṣṭhadeva (c. 1500-1610)

Jyeṣṭhadeva, this name being, most probably, the Sanskritised form of his personal name in the local language, has the distinction of

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1. Evidences for these identifications are being set out by the present writer elsewhere. Some scholars (cf. Raja, 155) ascribe to Śaṅkara Vāriyar the elaborate commentary Kriyākramakarī on the Līlāvatī on the basis of the similarity of some expressions in one of the introductory verses of that work with those in his commentary on the Tantrasaṅgraha However, there are clear evidences, which, as indicated above are being set out elsewhere, to show that the Kriyākramakarī is a work of Nārāyaṇa and not of Śaṅkara Vāriyar.

being the author of the popular *Yuktibhāṣā*[1] or *Gaṇitanyāyasaṅgraha,*[2] which forms an elaborate and systematic exposition of the rationale of mathematics in its Pt. I and of astronomy in its Pt. II. The Sanskrit version of this work, known as *Gaṇitayuktibhāṣa*, is also, in all probability, his work. An old astronomical document informs that he was the pupil of Dāmodara of Vaṭaśreṇi and was a member of the Parannoṭṭu family[3] of the Ālattūr village in South Malabar.[4] Nilakaṇṭha Somayāji, whose *Tantrasaṅgraha* he mentions towards the beginning of his work, was his respected elder. He himself was the teacher of Acyuta Piṣāraṭi who mentions him in reverential terms at the close of his *Uparāgakriyākrama* (A.D. 1592). M. Whish records a tradition that the author of the *Yuktibhāṣā* was the author also of a *Dṛkkaraṇa*[5] The *Dṛkkaraṇa* in question, which is now available in a single manuscript, is a comprehensive metrical treatise in Malayalam on astronomy. It does not give anywhere the name of its author, but gives in its last verse, its date of composition in the words *kolambe barhiṣūnau* (M.E. 783=A.D. 1603). In view of this date and the mention of the tradition recorded by Whish, it is quite possible that this is a work of Jyeṣṭhadeva.[6]

33. Jyeṣṭhadeva-Śiṣya (c. 1550-1625)

A disciple of Jyeṣṭhadeva, who studied *Tantrasaṅgraha* under him, has composed a metrical commentary on that work; this

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1. Pt. I. ed with elaborate notes by Ramavarma Maru Thampuran and A. R. Akhileswara Aiyar, (Mangalodayam, Trichur, 1948). See also, A. Venkataraman, 'Some interesting proofs from Yukti-bhāṣā,' *Mathematics Student*, 16 (1968) 1-7.

2. An extremely unreliable edition of the whole work has been issued under this title by the Govt. Or. Mss. Library, Madras, 1954.

3. An old Malayalam Ms. No. 9386, preserved in the Or. Inst., Baroda, reproduced by K.V. Sarma, in his paper 'Direct lines of astronomical tradition in Kerala', Pt: Charudeva Shastri Felicitation Volume, Delhi, 1972.

4. See Pārayil Rāman Nampūtiri, (ed.) *Nampūtirimār*, Trichur, M.E. 1093, (A.D. 1918), p. 65.

5. M whish, 'On the Hindu quadrature of the circle' etc, *Trans. Royal As. Soc.*, 3 (1835) 523.

6. On Jyeṣṭhadeva, see K.V. Sarma, 'Jyeṣṭhadeva and his identification as the author of *Yuktibhāṣā*', *Adyar Lib. Bul.*, 22 (1958) 35-40. On *Yuktibhāṣā*, see Raja, 156-58 ; Ul. III. 439-40 ; Ul. Sup. I. 612-16.

commentary extends, unfortunately, only to the first four of the eight chapters of that work.[1]

34. Māttūr Nampūtiri-s : Puruṣottama I and Subrahmaṇya I (c.1475-1550)

Two *Muhūrtapadavī-s*, out of the seven texts that go under that name, have been widely known as the works of two brothers belonging to the Māttūr (Skt. Mahāvastu) family in the village of Paññāl (Skt. Pañcālagrāma), near Chelakkara in Cochin. These two works, comprising, respectively, of 36 and 43 verses, condense in themselves, independently, the prescription of auspicious times for all the major social and religious functions and indication of the baneful times which are to be avoided. Their popularity, as attested by their numerous manuscripts as available and the several commentaries on them is matched only by the obscurity that surrounded the names of their authors. It has now been possible to identify both these writers. A unique manuscript of the first of these two works, preserved in the India Office, London, (Catal. No. 8070), carries a colophon giving the name of its author as Puruṣottama :

V(B)ṛhadāvṛtigehasambhaveni dvijarājñā Puruṣottamena |

gurunāthakṛpābalāt kṛtam yat tad idam sadviduṣām mude 'stu nityam ||

With regard to the second of the two works, a hitherto unnoticed commentary thereon available in the Āzhvāñceri Mana (List No. 81) etc., mentions in its introductory verse the name of the author of the text as Subrahmaṇya. *Cf.* :

'vṛddhimdheyād hitāyā'sau savitā vas trayīmayaḥ

yadraśmisambhramād bhānti jyotīṁṣy etāni santatam |

śrīsvarṇabhūmir vidvadbhir sevyā, padyair iyam kṛtā

Muhūrtapadavī yena Subrahmaṇyam praṇaumi tam ||

It is also of interest to note that the first words of the said verse, viz., *Vṛddhimdheyaddhitāya* (16,91,994), gives the date of composition

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1. *Cf.* the concluding verse :

ity eṣa Parakroḍavāsadvijavara-samīrito yo 'rthaḥ |

sa tu Tantrasaṅgrahasya prokto 'dhyāye caturthe 'bhūt ||

The view expressed by some scholars (*cf.* Ul. II. 120, Va. II. 498 and Intro., to the edn. of *Tanrasaṅgraha*, TSS 188) that the author of the commentary was a 'Brāhman of the Parakroḍa village' is not warranted by this verse.

of the work as A D. 1531, enabling the date of the author to be fixed correctly.[1]

35. Nārāyaṇa of Kāṇvavastu (c. 15th cent.) : Nārāyaṇa II

Nārāyaṇan Nampūtiri hailing from the village of Kāṇvavastu, which is differently identified with Tṛkkaṇṇapuram and Kaṇṇanparampu in Malabar, was the son of Keśava.[2] Nārāyaṇa's *Muhūrtadīpaka* is a comprehensive treatise in about 400 verses on the selection of auspicious times for social and religious functions and has been cited as an authority by Śaṅkara of Mahiṣamaṅgalam (see below).[3]

36. Rudra Vāriyar (c. 1475-1550) : Rudra II

Rudra (Mal. Uzhuttira) Vāriyar belonged to the Deśamaṅgalam Vāriyam, in South Malabar, which, during the middle ages, was a renowned centre of Sanskrit studies and a rich repository of manuscripts.[4] Rudra wrote in A.D. 1527 his elaborate commentary called *Naukā* or *Vivaraṇa* on Varahamihira's *Horā*.[5] His other known work is the *Aṣṭamaṅgalapraśna* on a type of astrological query which is very popular in Kerala.[6]

37. Śaṅkara of Mahiṣamaṅgalam (1494-1570) : Śaṅkara III

In the matter of the popularisation of studies on Jyotiṣa among the masses in Kerala, Śaṅkaran Nampūtiri of Mazhamaṅgalam

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1. On Māttūr Nampūtiri-s, see K. Sankara Menon, Intro. to his edn. of *Muhūrtapadavī II* with *Bālaśaṅkaram*, *Śrī Vanchi Setu Lakshmi Series*, No. 5, (Trivandrum, 1926); Ul. II.110-11 ; Va. II. 601-12.

2. Ulloor (II. 107) suggests that Nārāyaṇa might have been one of the teachers of Parameśvara of Vaṭaśreṇi. But this is not possible, for the name of the father of the present Nārāyaṇa is Keśava (cf.: *kaścid dvijo guṇakhyāta-'Keśavakhyadvij-ātmajaḥ' | Kāṇvavastv-āhvayagrāmajanmā Nārāyaṇāhvayaḥ ||*). while the name of the father of Parameśvara's teacher Nārāyaṇa was Parameśvara (cf. Nīlakaṇṭha Somayāji's statement on the subject : *Parameśvaras tu Rudra-'Parameśvarātmaja-Nārāyaṇa'-Mādhavādibhyo golavidbhyo gaṇitagola-yuktīr api bālya eva samyag gṛhītvā* etc. (*Āryabhaṭīya-bhāṣya, Gola.* 48 ; edn., Pt. III, p. 154).

3. On Nārāyaṇa, see Ul. II. 107 ; Va. II. 612-13.

4. For an account of this repository of Mss., see K.V. Sarma, 'Deśamaṅgalam Mss. collection' (in Mal.), *Mathrubhumi Weekly*, (Kozhikode), 8.2.1957.

5. Ed. *TSS*, No 91, Trivandrum, 1926 ; 2nd edn., Trivandrum, 1958.

6. On Rudra, see Ul. II. 114-17 ; Ul. Sup. I. 531-34.

(Skt. Mahiṣamaṅgalam) family had an important part to play. Śaṅkara hailed from the Perumanam village near Trichur but spent most of his active life at Chengannoor with his teacher Parameśvaran Poṭṭi of Vāzha-māveli house. In his work, *Rūpānayanapaddhati*, on grammar, Śaṅkara gives the date of his birth in the chronogram *jātoyam haṁsatulye*('hani) (Kali day 16,78,168), which falls in A.D. 1494.

Śaṅkara wrote a large number of works both on astronomy and on astrology, mostly in simple Malayalam poetry and easy prose. These works include *Gaṇitasāra*, *Candragaṇitakrama* and *Ayanacalanādi-gaṇita* in astronomy, *Jātakakrama* in horoscopy and *Praśnamālā* with *Bhāṣā* in astrological query. A work which he composed in two versions is the *Kāladīpaka*, called in general parlance *Ceriya Kāladīpakam* (Short Kāladīpaka) and *Valiya Kāladīpakam* ('Long Kāladīpaka'). He has a *Jātakasāra* in Sanskrit and another with the same title in Malayalam. He has commented on *Pañcabodha* (II) and *Pañcabodha* (IV).[1] His commentaries on *Laghubhāskarīya*, *Muhūrtapadavī*, *Pañcabodha* IV and his own *Kāladīpaka* II, all called *Bālaśaṅkaram*, have greatly helped the popularisation of these works among the people. On *Pañcabodha* IV, besides the *Bālaśaṅkaram*, he wrote another shorter (?metrical) elucidation entitled *Pañcabo-*

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1. A good amount of confusion has occurred in earlier writings in the identification of Śaṅkara's works. Thus, the *Jātakasāra*, noticed by Ulloor (II. 474) is, really, by a namesake of our author. Our Śaṅkara has actually composed two works under the title *Jātakasāra*, one in Sanskrit and the other in Malayalam ; Ulloor does not mention the former and describes the latter as an anonymous work (Ul. III. 241-42), failing to take note of the apparent Mahiṣamaṅgalm characteristics in it. Similarly, Ulloor does not take note of Śaṅkara's *Praśnamālā* and describes Śaṅkara's own *Bhāṣā* on it as an anonymous work (Ul. III. 242). Again, Ulloor describes Śaṅkara's *Bālaśaṅkaram*, called also *Pañcabodhakriyākrama* on *Pañcabodha* IV as the *Pañcabodha* of Śaṅkara, while Śaṅkara's commentary on *Pañcabodha* (II) is not noticed. Certain other works, viz , *Bhāṣāsaṅgraha*, *Praśnasāra* and *Karaṇasāra* have also been ascribed to our author but they do not appear to be his works. Of these, *Bhāṣāsaṅgraha* is a commentary by Vāsudeva on *Muhūrtapadavī* V and the *Praśnasāra* and *Karaṇasāra* are the works of different authors named Śaṅkara. A detailed study on the identification of Śaṅkara's works is being presented by the present writer elsewhere.

dhārthadarpaṇa. Śaṅkara is also reputed to have composed a 'Register of muhūrtas' for a 1000 years.[1]

38. Mādhava of Īñcakkāzhvā (c. 1500-75) : Mādhava II

Mādhava was a member of the Nampūtriri family of Īñcakkāzhvā in Rāmamaṅgalam in the Mūvāṭṭupuzha Taluk (Dt. Kottayam). He composed his *Praśnasāra* in A.D. 1543, in 16 chapters, based on earlier works like the *Horā,* but incorporating in it numerous local practices. The work is historically significant for it provides the names of several contemporary astronomical and astrological authorities like Nīlakaṇṭha Somayāji of Keḷallūr, Parameśvaran Poṭṭi of Vāzha-māveli, Attimaṭṭam, Vākkaṭ, Paḷḷimaṭṭam, Mecceri, Koyikkara and Araṇappuram.[2]

39. Acyuta Piṣāraṭi (c. 1550-1621) : Acyuta II

Acyuta Piṣāraṭi of Tṛkkaṇṭiyūr (Skt. Kuṇḍapura) in South Malabar, was a versatile scholar and original thinker on astronomy. It was he who enunciated, for the first time, in Indian astronomy, the correction called 'Reduction to the the ecliptic', in his work *Spuṭanirṇaya* (before A.D. 1593) and set out its rationale, elaborately, in his work *Rāśigolasphuṭānīti.*[3] As pointed out earlier, (see above pp. 12-14), this correction was first introduced in Western astronomy by Tycho Brahe, at about the same time. Acyuta was a protege of King Ravi Varma of Veṭṭattunāḍ (Skt. Prakāśaviṣaya) and was the teacher of the renowned poet and grammarian Melputtūr Nārāyaṇa Bhaṭṭa, who, in the *carama-śloka* which he composed at the death of Acyuta, expressed the date of the latter's demise in the chronogram, *vidyātamā svar asarpat* (17,24,514), which falls in A.D.1621. Acyuta has composed about a dozen works on Jyotiṣa, including *Karaṇottama,*[4]

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1. On Śaṅkara, see Koṭṭārattil Śaṅkuṇṇi, 'Muzhamaṅgalattu Nampūri', *Aitihyamala* IV, (4th edn., Trichur, 1958), pp. 89-93; Raja, 155-56; Ul. II. 269-72, 469-75; Va. II, 613-22; Ulloor, *Vijñānadīpika,* (Trivandrum), IV, pp. 187-95.

2. On Mādhava see Ul. II. 4ʾ5-77. R. Narayana Panikkar (II. 234-35) wrongly describes Mādhava's *Praśnasāra* as a commentary on the well-known *Praśnamārga.* It may be noted that the *Praśnamārga* was composed in 1650, more than hundred years after the composition of *Praśnasāra* (1543).

3. Ed. by K.V. Sarma, Adyar Library, Madras, 1955.

4. Ed. by K. Raghavan Pillai, *TSS,* No. 213, Trivandrum, 1964.

on astronomical computation, in five chapters, *Uparāgakriyākrama*,[1] and *Uparāgaviṁśati*[2] on eclipse computation, *Chāyāṣṭaka* on shadow computation and *Jātakabharaṇa* (?) and *Horāsāroccaya* on horoscopy. He has commented on the *Veṇvāroha* of Saṅgamagrāma Mādhava,[3] *Sūryasiddhānta* and on his own *Sphuṭanirṇaya* and *Karaṇottama*.[4]

40. Nīlakaṇṭha (16th-17th cent.) : Nīlakaṇṭha II

Nīlakaṇṭha II, about whom nothing more is known, is the author of a comprehensive treatise on arithmetic, entitled *Kaṇakku-sāram*, couched in *maṇipravalam* verses in Malayalam and a commentary thereon. The author claims to have based his work on Sanskrit texts like the *Līlāvatī* and old Malayalam texts like *Kaṇakkatikāram*. It is noteworthy that, besides the general mathematical procedures, this work deals also with practices relating to local grain transactions, housebuilding, weighing of gold and silver, land tenure, masonry, ground measurement etc.[5]

41. Nārāyaṇa III

Laghudarśinī, a short work on astrology, is the work of a Nārāyaṇa, about whom nothing more than his name is known at present.

42. Dāmodara II of Maṅgalaśreṇi (c. 1575-1675)

In Dāmodaran Nampūtiri of the Maṅgalaśśeri house in Kaṇṇātip-parampu in the Chirakkal taluk in N. Malabar, we have a reputed authority in astrology, of the times. His disciples included Iṭakramañceri Nampūtiri, author of *Bhadradīpa* and the anonymous author of *Jyotiṣasaṅgraha* (II), noticed below. Vaṭakkumkūr mentions

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1. This work. in four chapters, contains 130 verses, and not 20 as stated by Raja, 161.

2. Ed. by Rama Varma Maru Thampuran, *Ravivarma Granthāvali*, (Quarterly of the Skt. College, Trippunithura), 2 (1954) i-iii, 16 pp.

3. Ed. by K.V. Sarma, with text, Skt. College, Trippunithura, 1956.

4. On Acyuta, see, S. Venkitasubramonia Iyer, 'Acyuta Piṣārati and his works', *Jl. Or. Res.* 22 (1952-53) 40-46 : K.V. Sarma, Intro. to his edns, of *Rāśigolasphuṭānīti* and *Veṇvāroha*, *op. cit.* ; Raja, 158-62; Ul. II. 319-26 ; Ul. Sup. 1. 315 ; Va. II. 748-57.

5. On Nīlakaṇṭha, see Ul. II. 478-79 ; Ul. Sup. I. 226-27 ; Va. IV. 276.

two of his works, *viz.*, *Praśnarīti* (?) and *Līlāvatī-vyākya*, which, he adds, have been popular. Manuscripts of these works have, however, yet to be identified.[1]

43. Iṭakramañceri Nampūtiri (c. 1625-1700)

He is author of *Bhadradīpa-gaṇita* (A.D. 1665) but prefers to remain anonymous and refers to himself only by the name of his family, *viz.*, Iṭakramañceri (or Eṭakramañceri). He mentions his native place as Perumānūr in Malabar and his teacher as Dāmodaran Nampūtiri[2] of the Maṅgalaśśeri family. In eleven chapters, couched in easy Sanskrit-Malayalam verses, he provides the layman with the elements of astronomical computation. A shorter work entitled *Bhūgolanāyam*, composed in the same style and devoted to a description of the earth as suspended in the atmosphere, its main landmarks, the construction of the armillary sphere etc., has much in common with Ch. V of the *Bhadradīpa* and is likely to be another composition of our author.[3]

44. Maṅgalaśreṇivipra-Śiṣya (17th cent.)

An author, who does not give out his name and describes himself as a pupil of a Nampūtiri of the Maṅgalaśśeri family, has composed, in Malayalam, a *Jyotiṣasaṅgraha* (II). The Maṅagalaśśeri Nampūtiri in question is very likely to be the same as the Dāmodaran Nampūtiri, author of *Praśnarīti* I and teacher of Iṭakramañceri Nampūtiri, noticed above.

45. Panakkāṭṭu or Iṭakkāṭṭu Nampūtiri (c. 1625-1725)

The *Praśnamārga*, the most popular and authoritative work on *praśna* in Kerala, was composed in about A.D. 1650 (*cf. kolambe 'muraha'-saṅkhye*, M.E. 825) by a Nampūtiri of the Panakkāṭṭu family. Since his family was situated in a place called Iṭakkāṭ (or Eṭakkāṭ) (Skt. Madhyāṭavī or Madhyāraṇya), in North Malabar, he was known by that name as well. K. Mahadeva Sastri gives the name of the

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1. On Dāmodara, see Va. III. 378-79.

2. Va. III. 379 takes the word 'Dāmodara' occurring in the Intro., verse 2 of the *Bhadradīpagaṇita* as the author's name on the basis of the wrong reading 'Dāmodaro', instead of that of his teacher, as per the correct reading 'Dāmodaram'.

3. On this author, see Ul. III. 232-34.

author as Parameśvara, on what grounds it is not known.[1] The author gives the name of his parents as Mahādeva and Śrī. In 32 chapters, the work presents a detailed exposition of the different topics and types of praśna. The author has also supplied a lucid exposition called Durgamārthapradarśinī on the work. It has several commentaries in Malayalam also, including some produced during modern times. Panakkāṭṭu Nampūtiri is said to have composed in 1676 a work on astronomy, which is not available now.[2]

46. Iṭakkāṭṭu (or Eṭakkāṭṭu) Kukkaṇiyāḷ (c. 1675-1750)

The personal name of this author seems to be Śaṅkaran Kaṇiyār. He belonged to the house of Kaṇiyāṅkaṇṭi in Eṭakkāṭ in North Malabar and studied astrology under Panakkāṭṭu Nampūtiri. In later life, he came under the influence of a Yogi and spent his life in meditation. His Praśnarīti[3] in 20 chapters is very popular among astrologers of the Kaṇiyār caste. In its first twelve chapters, it is a free metrical rendering in Malayalam of his teacher's Praśnamārga and deals, in the remaining eight chapters, with other allied and miscellaneous matters.[4]

47. Rāma-śiṣya (17th cent.)

Manuscripts of a free explanatory rendering, in Malayalam verses, of the Laghujātaka or Laghuhorā of Varāhamihira, called Laghuhorāvivaraṇam have been identified. The author does not reveal his name but mentions his teacher Rāma and the date of composition of the work, viz., A.D. 1640. The author says in the beginning of the work that he had already composed a Horāsāra in Malayalam, possibly a free explanatory rendering, like the present work, of the Horā.

48. Puruṣottama II (c. 1650-1725)

A unique manuscript of the Uparāgapariccheda of a Pañcabodhaśataka (Pañcabodha V) is known. In 47 verses, this section of the work sets out the computation of solar and lunar eclipses, using its own

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1. See his Des. Cata. of Skt. Mss. in the Curator's Office Library, Trivandrum, vol. IV. (Trivaudrum, 1939), p. 1539.

2. On Panakkāṭṭu Nampūtiri, see Ul. III. 87-89; Va. III. 400-5.

3. Ed. serially in the Kavanodayam (Mal. monthly, Kozhikode).

4. On this author see Ul. III. 236-37; Ul. Sup. I. 536; Va. III.405-6.

revised multipliers, divisors and other constants. For the calculation of the precession of the equinox, it mentions the epoch *praudhasrī-guṇasevya* (17,53,242). This date works out to A.D. 1699 and gives a clue to the date of the author.[1]

49. Putumana Somayāji (c. 1660-1740)

The *Karaṇapaddhati*,[2] in ten chapters, is a comprehensive treatise on astronomy by an anonymous Somayāji of the Putumana or Putuvana (Skt. Nūtanagṛha or Nūtanavipina) family of Śivapuram (Trichur). The availability of manuscripts of the work in Tamil and Telugu scripts indicate its popularity in those regions as well. The work has been commented in Malayalam,[3] Sanskrit and Tamil. Its date of composition is said to be given in the concluding verse of the work by the chronogram *gaṇitam etad samyak* (17,65,653) which falls in A.D. 1732.[4] While *Karaṇapaddhati* is the best known work of the author in Jyotiṣa, it has been shown that he has written certain other works also in that discipline.[5] In *Nyāyaratna*, he deals, in eight chapters, with certain aspects of *Sphuṭa*, *Vikṣepa*, *Chāyā*, *Viparītacchāyā*, *Grahaṇa*, *Śṛṅgonnati*, *Mauḍhya* and *Vyatīpāta*. The object of writing the work is expressed in its concluding verse thus :

nyāyapradarśanāyaivam   gaṇiteṣvalpacetasām |

gaṇitābdhau nimajjyaitat Nyāyaratnam mayoditam ||

'This *Nyāyaratna* has been composed by me by delving into the depths of astronomy for demonstrating astronomical rationale to the dullwitted.'

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1. On Puruṣottama, see Ul. Sup. I. 224-25.

2. Ed. *TSS*, No. 126, (Trivandrum, 1937); with two old Malayalam commentaries, *Madras Govt. Or. Ser.*, No 98, (Madras, 1956) ; with a modern commentary by P.K. Koru, (Astro Press, Cherp, Kerala, 1953).

3. See fn. above.

4. Some scholars like Ulloor (II. 107-8) and Vaṭakkumkūr (I. 529-30) have held that this work was written in A D. 1430. For a refutation of this view and for conclusive evidences for a much later date, see K. V. Sarma, 'The date of Putumana Somayāji', (Mal.), *Mathrubhūmi W*, (Kozhikode), 5. 2. 1956. It has also been argued that the said chronogram, which according to the tradition recorded by Whish is the date of composition of the work, may not be so. However, in view of date indicated by the evidences set out in the said paper, there is no incongruity in believing the tradition.

5. On these, see K. V. Sarma, 'The hitherto unknown works of Putumana Somayāji' (Mal.), *Mathrubhūmi W*, *ib*. 29.1.1956.

The *Nyāyaratna* occurs in two versions, which differ slightly by the presence or absence of certain verses and in the arrangement thereof. The *Veṇvārohāṣṭaka* of Putumana Somayāji is a manual for the accurate determination of the moon at short intervals. His *Pañcabodha* III[1] is a practical manual for the computation of *Vyatīpāta*, *Grahaṇa*, *Chāyā*, *Śṛṅgonnati* and *Mauḍhya*. *Grahaṇagaṇita* IV commences with the characteristic introductory verse of Putumana Somayāji, *viz.*, *madīya-hṛdayākaśe* etc. and so is likely to be his work. So also *Grahaṇāṣṭaka* II, which, though a self-contained work, forms a part of the said *Grahaṇa-gaṇita*. K. Rama Varma Raja makes mention of a tradition which attributes to our author a work called *Mānasagaṇitam*.[2] This is likely to be the Malayalam commentary on *(Laghu)mānasa* which has now been identified and whose introductory verse contains words reminiscent of Putumana Somayāji's expressions. In horoscopy, he wrote the highly popular *Jātakādeśa(marga)*[3] which is known in two recensions, both of which might have been written by him.[4]

50. Vāsudevasvāmi : Vāsudeva I

Vāsudevasvāmi, who describes himself as a devotee of Viṣṇu, is the author of a treatise entitled *Kāladīpa*, dealing, mainly, with natural astrology. It is preserved in a unique manuscript procured from the Punnattūrkoṭṭa Mana, Koṭṭappaṭi, in Malabar. It is a comprehensive treatise dealing with a wide range of topics, which the author enumerates towards the beginning of his work.[5]

51. Śyāmalavāraṇarāja

The *Kāladīpa* of Vāsudevasvāmi has an elaborate commentary which gives the name of its author as Śyāmalavāraṇarāja. The

1. Included in the *Jyotiśśastrasubodhinī*. Pt. II, by Punnaaśśeri Nīlakaṇṭha Śarmā, (Triśśivaperur, M. E. 1104) and in *Pañcabodham Bhāṣā*, ed. by Kanippayyoor Sankaran Namputirippad, Kunnamkulam. M.E. 1107.

2. 'The brahmins of Kerala', *Jl. of the Royal As. Soc.*, 1910, p. 635.

3. Pub., Panchangam Press, Kunnamkulam, 5th edn., M. E. 1125 ; A.R.P. Press, Kunnamkulam, M.E. 1105.

4. On Putumana Somayāji. see K. V. Sarma, 'Putumana Somayāji', Proc. All-India Or. Conf., 18th Session, Annamalainagar, 1956, pp. 562-64 ; Intro. to *Karaṇapaddhati, op. cit.*, (Madras). pp. xxi-xxxi : Raja, 162-65 ; Ul. II. 107-9 ; Ul. Sup. I. 212-15 ; Va. I. 529-31 ; A. K. Bag ; 'Trigonometrical series in the *Karaṇapaddhati*, etc.', *Indian Jl. of Hist. of Sc.*, 1 (1966) 98-106.

5. On *Kāladīpa*, see Va. III. 392-94.

name is obviously the Sanskritisation of the author's Malayalam name. Since he describes himself as a 'rājā' and a manuscript of the work has been found only in in the palace of Punattūrkoṭṭa, it is likely that the author is a member of that household.[1]

52. Dāmodara of Bhāradvāja-gotra : Dāmodara III

He was a Nampūtiri who hailed from a village east of Tṛppa-raṅṅoṭ in Malabar and was the brother of Keśava, who was also his teacher. Two earlier scholars of his family were Yajña and Yajña's son Dāmodara. The *Muhūrtābharaṇa* of our author is an exhaustive text in nine chapters, devoted, respectively to : definitions, merits of neutral times, demerits of baneful times, merits of auspicious occasions, comparative potencies, auspicious times for : (a) religious functions beginning with *niṣeka* to marriage, (b) agriculture, consecration etc., (c) royal installations and (d) miscellaneous functions. A special distinction of the *Muhūrtabharaṇa* is that it provides very readable poetry from a deft-handed poet.[2]

53. Kṛṣṇa II

The *Āryabhaṭīya* has a commentary in Malayalam by an author whom its only known manuscript (India Office 6273) labels as Kṛṣṇa. He is different from Kṛṣṇadāsa, another commentator (see below), as shown by the difference in the beginning of the two commentaries.

54. Keraliya-dvija

An author who calls himself merely as Keraliya-dvija and does not give out his real name has written a good Malayalam commentary on the *Karaṇottama* of Acyuta Piṣaraṭi. No personal detail is known about this author.

55. Govinda-śiṣya

There is an anonymous author who describes himself as a devotee of Lord Śiva at Vaikkam (Skt. Vyāghra-grāma) in Central Kerala and as a pupil of Govinda. He has composed an elucidatory and highly popular commentary called *Balabodhinī* or *Balaprabodhinī* on the

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1. On *Kāladīpavyākhya*, see Va. III 393.

2. On Dāmodara, see Ul. II. 105-6 ; Ul. Sup. I. 210-11 ; Va. I. 383. Va's equating our Dāmodara of the 'Bhāradvāja gotra' with Dāmodara of Vaṭaśreṇi, who belongs to the 'Bhārgava gotra' is, obviously, not correct. So also his suggestion that Keśava was the father and not the brother of Dāmodara as found in the original manuscript of the work,

Jatakapaddhati of Parameśvara of Vaṭaśreṇi. His teacher Govinda is identified, generally, as Govinda Piṣāraṭi of the Kailāsapuram house near Vaikkom.[1]

56. Veṇād-brāhmaṇa

The *Jatakodaya* is a succinct work on astrology in 103 verses, whose author does not give out his name, but styles himself as a brāhman of Veṇād.[2] Veṇād, as is well known, is the name of the southern part of the erstwhile State of Travancore in Kerala.

57. Azhvāñceri Tamprākkaḷ (*c*. 1725-1800)

The painstaking enterprise and zeal for propagating, among the Nampūtiris, studies on Jyotiṣa, evinced by a member of the Āzhvāñceri Tamprākkaḷ's family is apparent from his serius of adapted texts and extensive commentaries thereon, covering the entire field of astronomy and astrology in eleven books. In the penultimate volume of the said works, *viz.*, *Phalasārasamuccaya-Bhāṣā*, while setting out his objectives, he makes a mention of his earlier works : "In the Malayalam area, those who are not eligible to learn Jyotiṣa study it. And, brāhmaṇas ask them about *muhūrta*, *praśna* etc. Since neither of these is proper, I, with a view to change this state of affairs through making the brāhmaṇas learn Jyotiśśāstra, summarised the most essential matters thereof in the *Jyotiśśāstrasaṅgraha* and, also prepared a commentary in Sanskrit-Malayalam on this *Saṅgraha*. Later, in order to enable the understanding of the working of the matters set out in the *Saṅgraha*, a *Saṅgrahasādhanakriyā* was written and also a Malayalam commentary thereon. Then I compiled the *Jatakasārasaṅgraha* and its Malayalam commentary. Then, in order to be of help in the drawing of horoscopes, I wrote the *Jātakānītimārga* and a Malayalam commentary on it. Later, with a view to enable an understanding of the results of astrological aspects, I compiled the work entitled *Phalasārasamuccaya*. Now, I am writing the present work, being its Malayalam commentary." The *Jyotiśśāstrasaṅgraha* is a résumé on the essentials of practical astronomy and astrology (text, 650 granthas ; *Bhāṣā* 1700 gr.) is in two parts : I. *Siddhāntaskandha* or *Gaṇitaskandha*, on astronomy and II. *Horāskandha*, comprising of Muhūrta, Jātaka and Praśna. The *Saṅgrahasādhanakriyā* (text, 150 gr. ; *Bhāṣa*, 600 gr.) is intended to indicate the working of the matters set out in the *Jyotiśśāstrasaṅgraha*.

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1. On this work see, Ul.III. 89-90 ; Ul. Sup. I. 464 ; Va. III. 382-83.
2. The actual expression is : *dvijena...dvi* (?) *Veṇāṭikadeśajanmanā.*

The *Jātakasārasaṅgraha* (text, 230 gr.) in six sections and the *Jātakānītimārga* (text, 200 gr. ; *Bhāṣā*, 1300 gr.) in fourteen sections are complementary texts on horoscopy. The *Phalasārasamuccaya*, the author's *magnum opus*, (text, 1300 gr.; *Bhāṣa*, 21,000 gr.), is an extensive work in three sections, devoted, respectively, to Jātaka, Praśna and Muhūrta. The Tamprākkaḷ wrote also a detailed commentary called *Tamprākkaḷ Bhāṣā* in Malayalam on *Muhūrtapadavī* II.[1]

The author does not give out his personal name anywhere in his works, but gives his family name, *viz.*, Āzhvāñceri Tamprākkaḷ.[2] Some of the manuscripts of his works are dated. The earliest of these dates, *viz.*, A.D. 1756, which is possibly, the date of composition of the work, occurs in a manuscript of *Gaṇitasārasaṅgraha* Section of *Jyotiśśāstra-saṅgraha*, Kerala C. 2183-I. This provides a clue to the author's date, which might be put as *c.* 1725-1800.

58. Vāsudeva of Vaḷḷimana : Vāsudeva II

Vāsudeva hailed from Kaṇṇamaṅgalam and wrote a metrical commentary on a hitherto unrecognised *Muhūrtapadavī* (V) beginning with the words *cakrārdham mṛtivaidhṛtam ca gulikaḥ*. Two versions of this commentary, which is called *Bhāṣasaṅgraha*, are known, one in 178 verses and the other in 185 verses;[3] to all appearances, Vāsudeva himself has effected this revision.[4]

59. Tuppan Nampūtiri of Iṭavaṭṭikkāṭ (*c.* 1725-1800)

Tuppan Nampūtiri was a member of the Iṭavaṭṭikkāṭ family of

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1. Pub. Keralakalpadruman Press, Trichur.

2. One of the ms. *Jyotiśśāstrasaṅgraha-Bhāṣā* (Kerala C. 2197-A) has the name of Kaypāñceri Tamprākkaḷ mentioned in the post-colophonic statement, though, without being 'specifically' stated as the author.

3. *Cf.* the concluding verses of the two versions :

   i. '*dāsakṛt*' (178) *ślokasaṅkhyā ca Vāsudevena nirmitā /*

      Vaḷḷimanṛu gṛham, deśam collinṛū Kaṇṇamaṅgalam // and

   ii. '*mandāyuḥ*' (185) *ślokasaṅkhyā ca Vāsudevena nirmitā /*

      Vaḷḷimanṛu gṛham, deśam collinṛū Kaṇṇamaṅgalam //

4. Ulloor, inconsiderate of the content of this work and the colophon (as above) at the end, wrongly takes (Ul. II. 272, 473) this work as an independent treatise and ascribes it to Śaṅkara of Mahiṣamaṅgalam on the basis of a superficial similarity of its introductory verses with those in the works of Śaṅkara.

Pāṅkode in Kunnathunad taluk, Dt. Kottayam, and was patronised by Maharaja Rāma Varmā, surnamed *Dharmarājā*, of Travancore. He was also a poet of some merit. His work on Jyotiṣa is *Muhūrtapadavī* VI, in 40½ verses.[1]

60. Nārāyaṇa of Iṭavaṭṭikkāṭ (c. 1728-1800) : Nārāyaṇa IV

Nārāyaṇan Nampūtiri of Iṭavaṭṭikkāṭ family was the younger brother of Tuppan Nampūtiri and was, like his brother, patronised by *Dharmarājā* of Travancore. He too was a poet of merit, both in Sanskrit and Malayalam and has left some exquisite writings. He wrote in Jyotiṣa *Muhūrtapadavī* VII, in 36 verses.[2]

61. Parameśvara II

The *Praśnaṣaṭpañcaśikā* of Pṛthuyaśas and the *Horā* of Varāhamihira have concise commentaries called *Parameśvarī* by a Parameśvara who has to be distinguished from his namesakes. In the commentary on the *Horā*, which is also called *Horābhiprāyanirṇaya*,[3] Parameśvara often adds his own explanatory verses in elucidation of the text.

62. Parameśvara, pupil of Śaṅkara : Parameśvara III

The *Horā* of Varāhamihira has a commentary called *Jātaka-candrikā* or *Viśvārthadīpinī* by a Parameśvara who describes himself as a disciple of a Śaṅkara, but about whom nothing more is known.[4]

63. Bhāradvāja-dvija (c. 1750-1800)

An astronomer who calls himself merely as *Bhāradvāja* has composed two important works, *viz.*, (1) *Gaṇitayuktayaḥ* which sets out the rationale of several mathematical and astronomical procedures and (2) *Karaṇadarpaṇa*, an advanced manual for astronomical computation. The former work cites frequently a 'Bhāṣyakāra' who is, obviously, Nīlakaṇṭha Somayāji, Jyeṣṭhadeva, the author of *Yuktibhāṣa*,

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1. On Tuppan Nampūtiri, see Ul. III. 470-76.

2. On Nārāyaṇa, see Ul. III. 470-76.

3. Ed. by K. Raghavan Pillai, TSS, Trivandrum, 1953.

4. On this author, see Va. III. 394.

and *Nyāyaratna,* most probably, the work of that name by Putumana Somayāji. The *Karaṇadarpaṇa* has been commented in Malayalam.

64. Nārāyaṇa of Perumanam: Nārāyaṇa V

Nārāyaṇan Nampūtiri of Perumanam village, near Trichur, is the author of an astronomical treatise entitled *Tantrasāra.* There is also a Malayalam commentary available on the work.[1]

65. Kṛṣṇadāsa (Koccukṛṣṇan Āśān) (1756-1812)

Koccu-kṛṣṇan Āśān was born in the family of Neṭumpayil in the Tiruvalla taluk of Kerala, as the son of an erudite astrologer named Rāman Āśān. He studied Jyotiṣa under his father as also under Śūlapāṇi Vāriyar of Kozhikode. He came of a long line of astronomers and astrologers and had several disciples who continued that tradition.[2] He was a great devotee of God Kṛṣṇa and was a poet with several works to his credit. His works on Jyotiṣa, all intended for the novice, include *Pañcabodha* VIII, in Malayalam verse, *Bhāṣājatakapaddhati,* being a free rendering-cum-commentary of the popular *Jatakapaddhati* of Parameśvara of Vaṭaśreṇi, incorporating several matters not dealt with in the original.[3] *Kaṇakkuśāstram* presenting mathematical procedures in Malayalam verse and a *Bhāṣa-Golayukti* which he mentions in his *Bhāṣājātakapaddhati* as a work which he intended to write but which yet remains to be traced.

A hitherto unknown work of Kṛṣṇadāsa is a commentary in Malayalam prose on the *Āryabhaṭīya.* The commentary is elucidative and quotes several authorities including Bhāskara I, *Laghubhāskarīya,* Saṅgamagrāma Mādhava, Parameśvara of Vaṭaśreṇi, *Karaṇapaddhati* and a *Prakāśikā* which remains to be identified.[4] A Malayalam

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1. On this, see Raja, 153.

2. *Vide* above, pp. 5-6.

3. Ed. by K. Sankara Menon. *Bhāṣajātakapaddhati, Sri Vanchi Setu Lakshmi Series,* No. 3, Trivandrum,.1926.

4. The relevent quotation occurs in the com. on *Gītikā* 5 and gives the number of Kalpa days up to the beginning of Kali : *Prakāśika enna granthattil varttamānakaliyugattil ninnu munpu atītannaḷāya kalpadivasannaḷ 'śarāśviṣaṭkhā-driśarādrivedakṛteṣuyugmasvara-sammitāḥ syat'* (7,25,44,75,70,625) *ennu paṭhikkappeṭṭiṭṭumuṇṭu.*

quotation from Parameśvara[1] poses a problem, for all known works of Parameśvara are in Sanskrit. Possibly, Parameśvara has written also in Malayalam or the passage in question is only a view of Parameśvara expressed in Malayalam.[2]

66. Śankara of Muktisthala (17th cent.) : Śankara IV

This author was a Namputiri who hailed from Mūkkola (Skt. Muktisthala) in North Malabar. He refers, in his works, to Nārāyana, his teacher on Jyotiṣa, and to his patron, the Zamorin of Kozhikode. In his *Mantrasāra*, he says that the name of his house was 'Rājakula' (Mal. ?) and that he imbibed his knowledge in *mantraśāstra* from Dāmodara, son of Nīlakantha of the Bhāradvāja-gotra, who belonged to Kundapura (Mal. Trkkantiyūr).[3] He wrote, on natural astrology, the *Samudrasāra*, called also *Ārūḍhapraśna* and *Lāñchana-śāstra*, a comprehensive work which dealt with omens, palmistry, astrological query etc. He is the author also of another work, in Malayalam *manipravāla* verses, tentatively entitled *Āyuḥpraśna*, but dealing, besides *Āyus*, with *Aṣṭamangala, trisphuṭa, viṣṭi* etc.[4]

67. Śankara V

A Śankara, about whom little personal details are available, is the author of two works, entitled *Jātakasāra* (III) and *Praśnasāra* (I).[5] Both are in Malayalam prose interspersed with Sanskrit verse and have four chapters each. The former deals with the main topics of practical astrology starting from the drawing of a horoscope, and the latter with astrological queries relating to age, marriage, children and profit and loss. He is, probably, the author also of *Praśnānuṣṭhana-paddhati*, which occurs in two versions, I and II.

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1. *Cf.* : '*ivite yojanakarṇam candrante madhya-yojanakarṇam akunnu*' *enninnane Parameśvarācāryar parañniṭṭumunṭu.*

2. On Krṣṇadāsa, see Ul. III. 519-27 ; Ul. Sup. I. 647-48 ; Va. III. 384-85.

3. For extracts, see Va. II. 719.

4. On Śankara, see Ul. III. 86-87 ; Va. II. 718-23.

5. Ulloor does not notice this *Jātakasāra*, which is different from its namesake by Śankara of 'Mahiṣamangalam'. Of *Praśnasāra* II, Ulloor (II. 473) takes Mahiṣamangalam Śankara as the author. This is unlikely, for this work does not bear any of the characteristic *mudrās* of the Mahiṣamangalam author.

68. Bhūtanāthapura-Somayāji

An anonymous Somayāji of Bhūtanāthapura, who was a disciple of Vaidyanātha has composed a comprehensive work on astrological query, entitled *Praśnasāra* (III).

69. Śankara VI

Śankara, about whom nothing more is known than his name, has composed a commentary in Malayalam to the *Praśnasāra* III of Bhūtanāthapura-Somayāji.

70. Śrīkumāra, son of Nīlakantha

Śrīkumāran Nampūtiri, son of Nīlakantha and pupil of Nārāyana, is the author of *Praśnāmrta*, a succinct work on astrological query. The author is good at versification and writes in a pleasing language. He mentions his village as 'Dvipakānana' (? Mal. Ānakkāt).

71. Nārāyanan Iaiyatu of Maccāt (1765-1843) : Nārāyana VI

Nārāyanan Ilayatu was a member of the Chāntampilli family in Maccāt near Cochin. He was a gifted poet, author of several poems in Sanskrit and Malayalam and a resourceful astrologer whose predictions have developed into legends.[1] He was patronised by the royal house of Cochin, especially by Śaktan Thampurān. In Jyotisa, he wrote the *Jyotisabhāsāvali*, called also *Maccattu-Bhāsa*, being an introduction to astrology, and the *Jātakadeśaratna*,[2] based on the *Jatadādeśamārga* of Putumana Somayāji.[3]

72. Parameśvara of Puradahanapura (c. 1775-1839) : Parameśvara IV

Parameśvara, disciple of Agnidatta, was a member of the Nampūtiri family of Purayannūr (Skt. Puradahanapura), in the Valluvanāt taluk of South Malabar. He was a poet of merit and is the author of two long poems in Malayalam. His significant contribution

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1. Several of these feats are described by Puthezhathu Rama Menon in his book *Śaktan Thampurān*, (Mangalodayam, Trichur).

2. Manuscripts of this work are yet to be recovered, but the work is referred to by Purusottama III, the grandpupil of our author, in his *Praśnāyana*, III.19, VIII 88, XV. 41.

3. On Nārāyana, see Kuttamaśśeri Nārāyana Pishāroti, 'The works of Maccāttu Ilayatu' (Mal.), *Sahitya Parishat Traimāsikam* (Ernakulam) 9 (M.E. 1119) 130-31, Ul. III 527-29; Ul. Sup. I. 648-49; Va. IV. 216-21.

to Jyotiṣa is his commentary *Varadīpikā*, composed, in A.D. 1815 (*cf.* '*naladhī*'-*saṅkhya-kolambe*, M.E. 990), on the *Muhūrtapadavī* II of Māttūr Puruṣottaman Nampūtiri. This commentary is highly elucidative, profusely documented and extremely elaborate, in 2000 granthas for a text of 35 verses. One of the important works quoted by Parameśvara is the *Prācīna-Muhūrtapadavī* (*Muhūrtapadavī* I), supposed to have been written by Govinda Bhaṭṭatiri of Talakkuḷam.[1]

73. Śrikaṇṭha Vāriyar of Veḷḷārakkāḍ

The popular *Jātakapaddhati* of Parameśvara of Vaṭaśreṇi has a lucid commentary in Malayalam which has been made available in print in a slightly adapted form by Kanippayyoor Saṅkaran Namputirippad.[2] The edition contains a verse, carried over from the original manuscript, to the effect that it was written (*likhitavān*) by Śrikaṇṭha, a 'devadāsa' of Śvetagrāmaṭavī (Mal. Veḷḷārakkāḍ). It is not definite, however, whether Śrikaṇṭha was only the scribe or the real author.

74. Ghaṭigopa (*c.* 1800-60)

Ghaṭīgopa, which is, presumably, not his real name but only the Sanskritisation of his personal or popular name,[3] calls himself a disciple of Parameśvara and a devotee of God Pādmanābha, the presiding deity of Trivandrum. His contribution to astronomy is in the form of two commentaries, one in Sanskrit and the other in Malayalam, on the *Āryabhaṭīya*. The commentary in Malayalam occurs in two

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1. On Parameśvara, see Ul. III. 476-77 ; Ul. Sup. I. 627 ; Va. II. 605-12.

2. Pub. under the title *Balapiṇḍavum āyurdāyavum*, Kunnamkulam, M.E. 1102 (A.D. 1927).

3. The South Indian village accountant is called *Maṇiyakkāran* ; this term, which can be rendered, literally, as 'clock-man' could give rise to the Sanskritisation 'Ghaṭigopa'. To hazard another specific suggestion : Prince Goda Varma Koyittampurān (1810-60) a member of the scholarly family of Kilimanoor and a resident of Trivandrum, had the distinction of constructing, all by himself, a clock, and, thereby, getting as present a golden bracelet from the reigning ruler of Travancore (Ul. IV. 57 ; RNP V. 21). Following this achievement, he gained the popular appellation 'Maṇikkāran Thampurān' ('Prince of the clock'). This prince was also a good astronomer. Can it be that he composed the commentaries on the *Āryabhaṭīya* under the Sanskritised version of his name 'Ghaṭigopa' ? In that case, the date arrived at on the basis of internal evidence (see below) and the author's being a devotee of God Padmanābha, would fit in well.

distinct versions, the longer one being nearly one and a half times in extent as the shorter. In the shorter version, under *Kalakriyā* 4, Ghaṭīgopa gives the rationale for the 248 *candra-vākyas*. An indication of his date is given by his mention of Putumana Somayāji's (1675-1750) *Pañcabodha, Chāyākhaṇḍa* 20, in the said shorter version of his commentary. Ghaṭīgopa might, for this reason, be palced after 1800.[1]

75. Goda Varmā, Vidvān Iḷaya Tampurān (1800-51)

Among the renowned scholars and patrons of literature produced by the scholarly royal house of Koṭungallūr, near Cochin, Goda Varmā, better known as Vidvān Iḷaya Tampurān, occupies a place in the front rank. He was a versatile scholar and has written profusely, both in Sanskrit and in Malayalam. In astronomy he has produced erudite commentaries in Sanskrit on the *Gaṇitādhyāya (Bhāskarīya-gaṇita)* and the *Golādhyāya* of the *Siddhāntaśiromaṇi* of Bhāskara II.[2]

76. Śaṅkara Varmā of Kaṭattanāṭ (1800-38)

Prince Śaṅkara Varmā, known also as Appu Tampuran, belonged to the royal house of Kaṭattanāṭ in North Malabar. He was an astute astronomer and his *Sadratnamālā*,[3] in six chapters, is a compendium of the Kerala school of mathematics and astronomy. The date of composition of the work is indicated in the concluding verse of the work by the chronogram *lokāmbe siddhisevye* (17,97,313), which falls in A. D. 1823. The author himself has written an elaborate commentary on the work, which, however, extends only up to verse 32 of the last chapter.[4]

77. Subrahmaṇya Śāstrī (1829-88)

Subrahmaṇya Śāstrī was a versatile scholar who hailed from the village of Nalleppalli in Chittur taluk (Cochin). His erudition extended to different disciplines, including Jyotiṣa, Mantraśāstra, Viṣavaidya,

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1. On Ghaṭīgopa, see Ul. III. 234-35 ; Ul. Sup. II. 535.

2. On Goda Varmā, see Ul. IV.31-44 ; Ul. Sup. II.19-23 ; Va. IV. 315-44.

3. Ed. with auto-commentary, in *Kavanodayam*, (Mal. monthly, Kozhikode), vol. 16 (1898),

4. On Śaṅkara Varmā, see Raja, 165-66 ; Sen, 191 ; Ul. III. 499-501 ; Ul. Sup. I. 635-37 ; Va. IV. 334-93.

Music and Dramaturgy, and has, to his credit, several works in Sanskrit, Malayalam and Tamil. His contribution to Jyotiṣa is his *Agaṇita* (A.D. 1851) which enunciates procedures to compute the planets for a thousand years.[1]

78. Subrahmaṇya of Kunnattu Mana (1835-1903) : Subrahmaṇya II

Subrahmaṇyan Tirumunpu was a member of Kunnattu Mana of Bhūtanāthapura (Payyanur) in North Malabar. He wrote a commentary called *Bhāvaprakāśaka* on the *Muhūrtadarśana Vidyāmādhava*. This commentary is very extensive, though it has not grown popular.[2]

79. Puruṣottaman Mūssatu (c. 1850-1900) : Puruṣottama III

Puruṣottaman Mūssatu of Kūttaleṭattu Mana is the author of *Praśnāyana*,[3] a comprehensive work in 1018 verses, distributed in fifteen sections called *ayana*'s, composed in A.D. 1881.[4] The author mentions, at the beginning of his work, his teachers as Bhāskara, Śaṅkara, Vahni and Nārāyaṇa and, at the close, he indicates the inspiration behind its composition :

Madhyāraṇyadvijāsyād vigalita iha yaḥ Praśnamārgo 'marādau'

kolambe, chatraśiṣyo 'sya ca viracitavān Jātakadeśaratnam |

tacchiṣyasyānumatyā Sthalipuranilayasy 'Āyanam' 'Praśna'to 'sau

Sṛprā-deśādhivāsī vyaracayam aham apy 'Uttamaḥ Pūruṣāṇām' ||

According to this statement, Madhyāraṇyadvija (Iṭakkāṭ or Panakkāṭ Nampūtiri) composed his *Praśnamārga* in the Kollam year *marādi* (825=A.D. 1650)[5] and a grand-pupil of his (identified with Nārāyaṇan Ḷayatu of Maccāṭ, 1765-1842) composed the *Jātakadeśaratna*. At the instance of a pupil of his from Sthalipura (Mal. Taḷipparampu), his

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1. On Subrahmaṇya Sastri, see Ul. IV. 292 ; Ul. Sup. II. 122-23 ; Va. IV 607; RNP IV. 481-82.

2. On this author, see Ul. Sup. I. 540 ; Va. I. 444.

3. Ed. by K. Raghavan Pillai, *TSS*, No. 223, Trivandrum, 1968.

4. Cf., *Praśnāyana* X. 14, *yātā 'rājadhavāḥ' samāḥ* and com. thereon *idānīm, 'rājadhava'* (4982) *ity akṣarasankhyā, samāḥ kalybdā, atītaḥ |* (Edn., op. cit., p. 176). Kali 4982 = A.D. 1881.

5. On this, see above, p. 66 § 45.

grand-pupil[1] Puruṣottama, who hailed from Sṛpradeśa (Mal. Tṛprayāer ?) composed the *Parśnāyana.* The work has a succinct commentary included in the edition of the work, which, too, to all appearances, has been composed by the author himself.[2]

80. Rāma Varma Koyittampurān (1853-1910)

Rāma Varmā of the royal house of Grāmam was a scion of the principality of Parappanāṭ which took refuge in Travancore when Tipu Sultan of Mysore invaded Malabar in 1807. He was a versatile scholar and author of several literary works. He studied Jyotiṣa under Prince Ampurājā at the Chirakkal Palace in North Malabar and composed, in that discipline, the *Jyotiṣapradīpa,* an instructive introduction to astronomy.[3]

81. The later phase

Among later scholars who continued the tradition of Jyotiṣa and who, by their expositions and interpretations, helped to sustain and promote astronomical and astrological studies in the land, a mention might be made of four important names : (1) Rāma Vāriyar of Kaikkulangara (1833-97), author of *Sāmudrikaśāstra* and *Gauliśāstra* and commentator of *Horā* and *Praśnamārga* ;[4] (2) A. R. Rajaraja Varma Koyittampurān (1853-1918) who wrote two studies entitled, respectively, *Karaṇapariṣkaraṇa* and *Pañcāṅgaśuddhipaddhati*[5] and *Jyotiṣaprakāśana,*[6] being

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1. Elsewhere also in this work, Puruṣottama refers to his teacher's teacher as the author of *Jātakādeśaratna. Cf., madguror-śrīguror vaktraj Jātakādeśam utthitam* (III. 19) and *Śrīman-madgurunāthasadgurumukhaj jātaḥ sphuṭam Jātakādeśas tena* (VIII. 88). The contraction cf *Jātakādeśaratna* to *Jātakādeśa* in the above references is, obviously, due to metrical exigencies.

2. On Puruṣottama, see Ul. Sup. I. 225.

3. On Rāma Varma, see Ul. IV.544-50.

4. On Rāma Vāriyar, see the biography included in P. V. Krishna Variyar, *Maṇmarañña sāhityakāranmār* (Mal.) : Ul. IV. 267-76 ; Ul Sup. II. 107-16 ; Va. IV. 587-607.

5. Pub. Trivandrum.

6. Ms. No. 719, *Des. cata. of Skt. Mss. in the Curator's Office Library,* vol. V, Trivandrum, 1939, pp. 1489-91.

an exposition of the *Golādhyāya* of Bhāskara II ;[1] (3) Vāsuṇṇi Mūssatu of Veḷḷānaśśeri (1855-1914), author of an erudite commentary in Malayalam on *Pañcabodha* ;[2] and (4) Punnaśśeri Nampi Nīlakaṇṭha Śarmā (1858-1935) who compiled a very instructive manual on astronomy under the title *Jyotiśśastrasubodhinī* with an extensive elucidation[3] and wrote a *Pañcabodhakriyā-Bhāṣā*, besides commenting, elaborately, on the *Camatkāracintāmaṇi* and the *Praśnamārga*, both published through the Bharata Vilasam Press, Trichur.[4]

82. Modern times

It is significant that, even during modern times, compendiums on astronomy and manuals of computation in Sanskrit continue to be composed by traditional exponents of the discipline.[5] And, what is more interesting is that some of the Western advances, corrections and methods have been duly taken note of and appropriately incorporated in the Sanskrit texts and elucidated in the Malayalam expositions, in these works.[6]

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1. On Rājarāja Varma, see Ul. V.791-827 ; Ul. Sup. II. 436-49 ; Va. VI. 27-65.

2. On Vāsuṇṇi Mūssatu, see Ul. IV. 698-703 ; Ul. Sup. II. 373-76.

3. Pub. in 2 parts, Trissivaperur, M.E. 1097, 1104 (A.D. 1922, 1929).

4. On Nīlakaṇṭha Śarmā, see Ul. V. 964-70 ; Ul. Sup. II. 500 ; Va. V. 192-204.

5. See, for instance, *Gaṇitanirṇaya* by P. S. Purushottaman Namputiri, (2nd edn., Quilon, M.E. 1127—A.D 1952) ; *Gaṇitaprakāśikā* by K.V.A. Rama Potuval, (Kannoor, 1950) and *Śuddha-Dṛggaṇitam* by V. P. Kunhikkanna Poduval, (Payyannur, 1956). All these works are in Sanskrit and are provided with Malayalam expositions by their authors themselves.

6. See, for instance, the innovations adopted in the *Gaṇitanirṇaya* of Purushottaman Namputiri, (*op. cit.*), such as fourteen of the Western corrections for the moon, a revision of the traditional astronomical constants in the light of the modern value for the mean motion of the Sun, sine-tables prepared on the basis of the ellipse instead of the circle and revised mnemonics for computations.

A BIBLIOGRAPHY OF KERALA JYOTIṢA LITERATURE

The Bibliogrphy of Kerala Jyotiṣa Literature which is presented here is intended to document information on the manuscripts, studies and other references to Kerala authors and works in the allied disciplines of astronomy and astrology. The authors and works, with their dates and other essential identificatory or descriptive details, wherever necessary, have been arranged in one alphabetical sequence, the former being printed in thick roman type and the latter in bold italics. Since the works whose authors are known are automatically identified by those authors, the identification of anonymous works has been sought to be achieved through the supply of extracts of the initial lines of the respective works. Wherever some amplification seemed necessary, that has been supplied by extracting end-passages and colophons ; this has been done also to set out hitherto unknown information.

The nature of the contents of the works has been indicated by adding, after the titles, their subjects such as : Astronomy (astron.), Saṁhitā, Tantra, Karaṇa (kar.), Eclipse computation (ecl.), Astrology (astrol.), Jātaka (jā.), Praśna (pra), Muhūrta (muh.), Prognostication, Natural astrology (nat. astrol.), arithmetic (arith.) etc. Sanskrit works are given no special indication to that effect but Malayalam works are distinguished by the addition of '(Mal.)' after their titles.

Often, different works bear a common name, (*e.g. Pañcabodha*), and all their manuscripts are bunched together in catalogues. In such cases, an attempt has been made to examine the manuscripts and identify them for this Bibliography and give against each distinct work the manuscripts relevent to it. Authors or works having a common name have been distinguished by the addition of I, II etc., to their names. So also the different commentaries on the same work. When a work does not give its title and therefore a title had to be assigned to it on the basis of its contents, the fact is generally indicated by the addition of '(?)' after the title. The symbol '(?)' is used also when a doubt is entertained about any matter. When the Kerala origin of a work is suspect that is indicated by adding '(Ker. ?)' to it.

Whenever it was felt that some purpose would be served by indicating the extent of a work, that has been done by noting the numbers of its sections or the number of *granthas* (32 syllables) it is comprised of.

The documentation of the manuscripts of works is intended more as indicatory than as exhaustive. When only a single manuscript or just a few manuscripts are known, the numbers of all the manuscripts have been noted. When, however, a large number of manuscripts of a work are known, the references to the relevent manuscripts catalogues alone are given or a few manuscripts noticed. Incomplete manuscripts are indicated by the addition of '(inc.)' to their numbers.

All the major repositories of Kerala manuscripts have been examined, either directly or through their catalogues of manuscripts, for the work on this Bibliography. The Kerala University Oriental Research Institute and Mss. Library, which, now, houses all the Trivandrum collections, is by far the largest of these repositories and had been most useful in the present work. In this Bibliography, references to the manuscripts germane to the University Collection[1] are given merely by their Ms. numbers, with no other indication. The numbers of the manuscripts belonging to the erstwhile Curator's Office Collection[2] are prefixed with 'C', those of the Curator's Office (Malayalam) Collection,[3] with 'CM', the Loan Collection with 'L', the Maharaja's Palace Collection,[4] with 'P', the Palace Malayalam Collection,[5] with 'PM', Transcripts Section with 'T' and Transcripts (Malayalam) Section, with 'TM'. Of the other collections, that of the Adyar Library and Research Centre[6] is indicated by 'Ad', the Oriental Institute, Baroda,[7] by 'Baroda',

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1. *Alphabetical Index of Skt. Mss. in the Univ. Mss. Library.* (*Ker.*), Trivandrum, 2 vols., 19ɔ7, 1965 ; *Index of Malayalam Manuscripts.* (*Ker. Mal.*), Trivandrum, 1951.

2. A *Des. Cata. of Skt. Mss. in the Curator's Office Library,* Trivandrum, 10 vols., 1937-41.

3. *Do. of Mal. Mss:,* Trivandrum, 3 vols., 1941;

4. A *Des. Cata. of Skt. Mss. in H. H. the Maharaja's Palace Library,* Trivandrum, 8 vols., 1937-38.

5. *Do, of Mal. Mss.,* Trivandrum, 2 vols., 1939.

6. *Alphabetical Index of Skt. Mss. in the Adyar Library,* Madras, 1944.

7. *An alphabetical list of Mss. of the Or. Institute,* Baroda, 2 vols., 1942, 1950.

the Government Or. Mss. Library, Madras,[1] by 'Mad.', S.V. Oriental Institute, Tirupati,[2] by 'Tir.', the India Office Library, London,[3] by 'IO' and the Whish Collection of the Royal Asiatic Society, London,[4] by 'Whish'. Other public and private collections have been indicated by their full names. The *Catalogus Catalogorum of Sanskrit works and authors* (CC) by T. Aufrecht (Leipzig, 3 vols., 1891, 189<, 1903 ; Rep., Wiesbaden, 1962) and the *New Catalogus Catalogorum* (NCC), (Madras University, 1949 ff.) are also referred to when necessary.

For facilitating general information and further study of individual works and authors, such details as the editions of the works, if available, and references to special articles on them are supplied towards the end of each entry. Besides these, their treatment in such important sources as ': Ulloor, *Kerala Sahitya Charitram* (Ul.), (5 Vols., Trivandrum, 1953-57), Vatakkumkur, *Keraliya Samskrita Sahitya Charitram*, (Va.), (6 vols., Trivandrum-Trichur, 1938-65), and *Kerala Sahitya Charitram—Chacchayun Purāṇavum*, (Ul. Sup.), (2 vols., Trichur, 1967-69), R. Narayana Panikkar, *Kerala Bhasha Sahitya Charitram*, (RNP), (7 vols., Trivandrum, nd.-1951), S.N. Sen, *Bibliography of Sanskrit works on Astronomy and Mathematics*, (Sen), (New Delhi, 1966) and K.K. Raja, 'Astronomy and Mathematics in Kerala : An account of the literature', (Raja), (*Adyar Library Bulletin*, 27 (1963) 113-67), has also been duly indicated. Other relevant pieces of information also find their due place here.

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1. *An alphabetical index of Skt. Mss. in the Govt. Or. Mss. Library*, Madras, 3 vols., 1938, 1940, 1942.

2. *An alphabetical index of Sanskrit, Telugu and Tamil Mss. in the S.V.Or. Res. Inst. Library*, Tirupati, 1956.

3. *A Cata. of Skt. and Pkt. Mss. in the India Office Library*, by J. Eggeling, 2 pts., London, 1887, 1896 ; and A.B. Keith, 2 pts., London, 1935.

4. *A Catal. of South Indian Skt. Mss.*, (*especially those of the Whish Collection*), *in the Royal As. Soc.*, London, by M. Winternitz, London, 1902.

Aṁśakadaśanyanam (jā.), (Mal. prose), Anon. 30 gr.

Ms. L. 765-B.

Aṁśakaphalavicāra (jā.), Anon. (Skt.-Mal.), 125 gr.

Beg. guror api ca saṁvāda iṣṭadaivatandanam /
kalivākyāni lagnam ca sūryādyeṣu grahasphuṭam //

Ms. TM. 119.

Akāradipraśna (pra.), (Mal.), Anon.

Beg. Vālmīkiṛṣiproktam Rāmabhadrasvāmi-kathā. Śrī. Praśnam.
Akārādi akṣaram, 1 pustaka-lakṣaṇam kāṇum prakāram.
grantham keṭṭikkoṇṭu kāryam vicāriccu etc.

Ms. CM. 2262.

Akṣarapraśna (pra.), (Mal.), Anon.

Ms. See *Ker. Mal.*, p. 1 ; Ad.

Do.—C (Mal.)

Ms. See *Ker. Mal.*, p. 1.

Agaṇita (kar.), (A.D. 1861) by Nalleppaḷḷi Subrahmaṇya Śāstri
(A D. 1829-88), enunciating facile methods to read out positions of
the planets for 1000 years.

Ref. : Ul. IV. 290, 292 ; Ul. Sup. II. 122-23 ; Va. IV. 607;
RNP IV. 481-82.

Agaṇitagrahacāra or *Agaṇitapañcāṅga* (kar.), by Mādhava of
Saṅgamagrāma, 2000 gr.

Beg. ādityapramukhān kheṭān vande lokaprakāśakān /
Agaṇitagrahacāre dṛśyate rāśinirṇayaḥ //1//
śakābdāt naralokonād rāghavair dhītsunā kujaḥ /
divylokonanīlāgrais tattvajñair bhājito budhaḥ //2//

Mss. 5955-A, C. 628, T. 280.

85

Aṅkaṇaśāstra, called also *Grahasamaya* or *Navagrahasamaya* (ja.), Anon., by a native of Vaikkam, couched in the form of a dialogue between Vyāghrapāda and some sages, in 4 chs., in 425 gr.

Beg. Vyāghrapādam aham vande śesāṁśena samudbhavam /
puṇḍarīkapureśasya padapaṅkajasaṁśrayam //

śṛṇvantu munayaḥ sarve durūham sarvadaivataiḥ /
grahāṇām samayam hyagre vakṣyāmi matimātrataḥ //

Ms. T. 206. **Ed.** *TSS*, No. 222, (Trivandrum, 1968). **Ref.** Ul. Sup. I. 221-22.

Acyuta I

—*Devakerala*, called also *Keralajyotiṣa, Candrakalānāḍī* and *Candranāḍī*.

Mss. Mad. D. 1377ɛ-79, R. 853 (a), 3322. **Ed.** Gov. Or. Mss. Lib., Madras, 3 vols., 1952-56. **Ref.** See above, p. 46, § 9.

Acyuta II : Acyuta Piṣāraṭi, (1550-1621), of Tṛkkaṇṭiyūr, pupil of Jyeṣṭhadeva and teacher of Nārāyaṇa Bhaṭṭatiri ; patronished by king Ravi Varmā of Veṭṭattunāḍ ; had a long line of teachers and pupils.

—*Uparāgakriyākrama*
—*Uparāgaviṁśati* (?)
—*Karaṇottama*
—C on *Karaṇottama*
—*Chāyāṣṭaka*
—*Jātakābharaṇa*
—*Rāśigolasphuṭānīti*
—C on *Veṇvāroha of Mādhava*
—*Sphuṭanirṇaya*
—C on *Sphuṭanirṇaya*
—*Horāsāroccaya*

Ref. See above, pp. 12 ; 64-65, § 39 ; K. V. Sarma, Introductions to his edns. of *Rāśigola°* and *Veṇvāroha ;* S. V. Iyer, 'Acyuta Piṣāraṭi : His time and works', *JOR* 22 (1952-53) 40-46 ; Raja, 158-62 ; Ul. II. 319-26 ; Ul. Sup. I. 315 ; Va. II. 748-57.

Adhimāsanirṇaya, (astron.), Anon.

Beg. : meṣādyaikaikarāśisphuṭagatidinakṛtsaṅkramaikaikagarbhāḥ.
Ms. L. 1229-D (with C, 65 gr.).

Adhimāsanirṇaya (contd.)

Do—C (interspersed with Mal.), Anon.

> **Beg.** : dvādaśamāsātmakatvena lokavedaprasiddhasya Cāndrasaṁvatsarasyāṅgabhūtānām lakṣaṇam aha—mcṣādāvekaikasmin rāśau sphuṭagatyā.

Ms. : L. 1229-D.

Ayanacalanādigaṇita (astron.), (Mal.), by Śaṅkara of Mahiṣa maṅgalam.

> **Beg.** tumpa tiṅkaḷoṭu gaṅga tanneyum etc.
> candradhjlagnasaṁyuktam koḷḷasaṅkhyayutam kramāt etc.

Ms. PM. 4026-A. **Men.** Ul. II. 272.

Aṣṭamaṅgalapraśna I (pra.), by Rudra II (?)

> **Beg.** jayati bhagavān gajāsyo etc. // 1 //
> satyajñānapradāyeṣṭa etc.

Ref. Ul. II. 117.

Aṣṭamaṅgalapraśna II (pra.), Anon., prose.

> **Beg.** svasthacitto'pi vittasthaḥ samabhyarcya gaṇādhipam |
> nijān gurūn devatāś ca sūryādiṁś ca navagrahān //
> ...anantaram viḷakkum gaṇapatiyum vaccu aṣṭamaṅgaḷavum vaccāl rāśicakram varappū |

Ms. 3556-C, 13494-K, CM. 565-A. **Ref.** Ul. III. 245.

Aṣṭamaṅgalapraśna III (pra.) Anon., (Mal. pr. and verse), 160 gr.

> **Beg.** dūtasvabhāvam vacanam pravṛttim
> sthalam ca tante svaravum svavṛttim |

Ms. PM. 4029.

Aṣṭamijayantīnirṇaya (astron.), by Puṛayaṇnūr Parameśvaran Nampūtiri (or Puradahanapura-dvija), A.D. 1810. 300 gr.

Ms. CM. 6-E. **Ref.** Ul. III. 476-82 ; Ul. Sup. I. 220-21.

Aṣṭakavarga (jā)

Ms. See *Ker.,* I. p. 43.

Do—C. (Mal.).

Ms. 6065-B,

Aṣṭakavargaprayoga (jā.), (Mal. prose), Anon.

Ms.   6065-B.

Aṣṭakavargaphalavicāra (jā.), (Mal.), prose, Anon, 225 gr.

Beg.   ādityante aṣṭakavargattil paral pizhaiyāte etc.

Ms.   C. 2338-C.

Aṣṭakavargopadeśam (jā.), (Mal. prose), Anon., 150 gr.

Ms.   C. 565-C.

Aṣṭavargaprakāra (jā.), (Mal. prose), Anon.

Ms.   13294-Q.

Aṣṭavargaprakriyā (jā.), Anon., (Skt.-Mal.).

Beg.   ...   .kanyāmakarau
           śaraiś ca seṣāḥ svamānaguṇitāḥ syuḥ /

Ms.   C. 962-B.

Aṣṭavargaprayoga (jā), Anon.

Beg.   athāṣṭavargaprayoga ucyate. putro vāso dadhānaḥ syāt.

Ms.   P. 894-B.

Aharganadiganitam (?) I (kar.), (Mal.), Anon.

Beg.   vākyasaṅkhyakaḷ vaccittu cenna tīyatī kūṭṭiyāl /

Ms.   10967-F (inc., 25 gr.).

Aharganadiganitam (?) II, (kar.), (Mal.), Anon., in verse.

Ms.   13295-I (inc., 170 gr.).

Aharganadiganitam (?) III, (kar.), (Mal.), in prose and verse.

Ms.   142 8-E (inc., 24 gr.).

Aharmanadiganitam (?) I, (kar.), Anon. Epoch :   Kali 17,21,162
A.D. 1611.

Beg.   'pritāsyādyarasāyano'nadivasān modādhya-putram tyajet

Ms.   1005-C.

Do—C (Mal.), *Anon.*

Ms.   1005-C.

Aharmanadiganitam (?) II, (kar.), (Mal.), prose.

Beg.   talkālacandran oṇṭākkuvān vākyam vaccu.

Ms.   L. 765-H (inc., 140 gr.).

Aharmānadigaṇitam III (kar.), (Mal.), Anon.

Beg. purabhaktiḥ, sudhanedhyā, nrpapaṭukapi, nityanindādhisūta-mūlādhyo meṣanaya rṇam yuṭaniyataprātāḥ (?) itu ubhe aharmānam.

Ms. PM. 4328-B.

Ācāradarśana (astrol.), Anon., by a pupil of Śankara and Śrī-vallabha.

Beg. ... vande Śankaram Aṣṭamūrtijanakam Śrīvallabham vā gurum.

Ms. 1055-G.

Ācāradīpikā : Name of C on *Muhūrtāṣṭaka.*

Ācārasangraha I (muh.), by Parameśvara of Vaṭaśreṇi.

Ms. : See *Ker.,* I. p. 54. **Ref.** Va. II. 686-87 ; III. 394-95 (where the work is said to be different).

Do.—C (Mal.), Anon.

Beg. Ācārasangramākunna muhūrta-granthatte camappān tutaṅ-ṅunna ācāryan.

Ms. 773-B.

Ācārasangraha II (muh.), (Mal. prose), Anon., 2200 gr.

Mss. 5886-A, L. 1286.

Ānandaprakaśa, teacher of Nityaprakāśa Yati (au. of C on Horā)

Āyuḥpraśna (pra.), (Mal.), by Śankara of Muktisthala.

Mss. 5109-A, 10582-C-2, C. 565-B.

Āyuḥpraśnadicintanam (pra.), (Mal. prose).

Ms. 13494-E.

[*Āyudhapraśna* (pra.), Anon.]

Do.—C (Mal.), Dūtalakṣaṇabhāṣāvyākhyā, 175 gr.

Beg. Āyudhapraśnasya dūtālakṣaṇa-bhāṣā likhyate / dūtan kizha-kkoṭṭu ninnu iṭakkaikoṇṭāyudham piṭiccu.

Ms. C. 173-D.

Āyudhalakṣaṇam I (pra.), (Mal.), in verse, Anon., in 4 chs., 110 gr.

Beg. gurupādatte vandiccu kuaryekkoṇṭu bhāṣayāy /
      arivāniha collunnen aham Āyudhalakṣaṇam //

Ms. See *Ker Mal.*, p. 16 ; P. 970-B ; PM. 4026-D.

Āyudhalakṣaṇam II (pra.), (Mal.), in verse, Anon., 62 gr.

Beg. ampiḷikkala cūṭunna tampurān mūttaputrane /
      mumpil tozhutu kumpiṭṭen vanpōlum vāṇimāteyum //
      arālum keṭṭinikkunnor āyudhathinnu lakṣaṇam /
      arivān jñānadṛṣṭikku guruvin varam ekuka //

Ms. CM. 127-C.

Āyurdayagaṇitam (?) (astrol.), (Mal.), Anon. in prose.

Beg. āyurdāyam varuttān jātakam varuttū.

Ms. L. 144-P, L. 1217-B.

Ārūḍhapraśna, by Śaṅkara : See *Sāmudrikasāra*.

[*Āryabhaṭīya* (tantra), by *Āryabhaṭa*]

Do.—C I, *Bhaṭaprakāśa* or °*prakāśikā* by Sūryadeva-yajvan, 2500 gr.

Mss. : See *Ker.*, I. p. 74 ; Ad., Mad.

Do.—C II, *Bhaṭadīpikā* by Parameśvara of Vaṭaśreṇi.

Mss. 10617, C. 1363-B ; Mad. Edn. H. Kern, Leiden, 1874 ;
      Udaya Narain Singh, Etawah, 1906.

Do.—C III, *Bhāṣya*, (for Gaṇita, Kālakriyā and Gola Sns. only, but
not for Gītikā Sn), by Nīlakaṇṭha Somayāji, 4000 gr.

Mss. : See *Ker.*, I. pp. 73-74, *NCC* II. 172. Edn. *TSS* 101, 111, 185.
Ref. : Ul. II. 119-20.

Do.—C IV, by Ghaṭīgopa, (Skt. com.).

Mss. 13305-A, T. 736.

Do C V, (Mal.) by Ghaṭīgopa, version I, 1200 gr.

Beg. of Gaṇitapāda : gaṇitapādattiṅkal muppattimūnnārya-
kaḷekkoṇṭu yuktisiddhamāyirikkunna gaṇitatte colluvān
tuṭaṅṅunna Āryabhaṭācāryan naṭette sūtram koṇṭu iṣṭa-
devatānamaskāravum cikīrṣita-pratijñayum ceyyunnū—
Brahma-śaśi etc.

[*Āryabhaṭīya*, C V, contd.]

Mss. 11014, L. 1334, T. 157-A, Mad. Mal. 215 ; ms. with K.V. Sarma. Ref. Ul. III.234-35.

Do.—C VI, (Mal.), by Ghaṭigopa, version II, 1850 gr.

Beg. of Gaṇitapāda : Āryabhaṭacāryan Daśagīti-sūtram āyirikkunna prabandham koṇṭu atīndriyam āyirikkunna arthajātatte updeśiccittu...śāstratte ārambhikkunnū—Brahmaśaśi etc.

Mss. C .2333-A, T. 157-B.

Do.—C VII, Anon.

Beg. vāgmajamahikṣapam kṛjñāśukrasūryārasūriśanibhā (?) ... /
... ... vyākhyāyate'tha tattantram //

Ms. L. 1347-A (Inc., 2600 gr.).

Do.—C VIII, Anon.

Beg. athācāryāryabhaṭo Daśagītisūtram ārabhamāṇas tadvighnopaśāntaye bhagavate svayambhuve praṇāmam kṛtvā.

Ms. C. 1828.

Do.—C IX, Anon.

Beg. (of *Kālakriyā*) : atha kālakriyāpādo vyākhyāyate. atra kālavibhāgam āha.

Mss. C. 2160-C (*Gaṇita* and *Gola* portions, 650 gr.) ; C. 2160-D (*Kālakriyā*, 450 gr.).

Do.—C X (Mal.), by Kṛṣṇa (?).

Beg. Āryabhaṭācāryan tantratte ārambhippān.

Ms. IO 6273 (all the four sections cm. : **Rem.** The label on the ms. reads '*Bhāṣayām Kṛṣṇaṭīkā*' (?). The au. is diff. from Kṛṣṇadāsa, below, since the beg. of the two coms. differ.

Do.—C XI (Mal.), *Daśagītisūtram Bhāṣā*, by Kṛṣṇadāsa (Kṛṣṇan Āśān).

Ms. with K.V. Sarma.

Do.—C XII : See *Kakṣyāmaṇḍala* etc.

Azhvāñceri Tamprākkaḷ, (18th cent.), son of Nīlakaṇṭha's brother. While several mss. mention Āzh. as the author, a lone ms. (C. 2197-A, *Jyotiśśāstrasaṅgraha*) mentions Kaypāñceri Tamprākkaḷ instead, in the post-colophonic statement.

Azhvāñceri Tamprākkaḷ (contd.)

—*Jātakasārasaṅgraha*

—C (Mal.) on Do.

—*Jātakanītimārga.*

—C (Mal.) on Do.

—*Jyotiśśāstrasaṅgraha*

—C (Mal.) on Do.

—*Phalasārasamuccaya*

—C (Mal.) on Do.

—C (Mal.) on *Muhūrtapadavī* II

—*Saṅgrahasādhanakriya*

—C (Mal.) on Do.

Ref. See above, pp. 71-72, § 57 ; Va. II. 123-27.

Iṭakkāṭṭu or Eṭakkāṭṭu Kukkaṇiyāl (17th cent.), pupil of Panakkāṭṭu Nampūtiri (au. of *Praśnamārga*).

—*Praśnarīti* II (Mal.).

Ref. See above, p. 67, § 43 ; Ul. III. 235-37 ; Ul. Sup. I. 536 ; Va. III. 405.

Iṭakkāṭṭu Nampūtiri : *See under* Panakkāṭṭu Nampūtiri.

Iṭakramāñceri Nampūtiri (17th cent.) ; of Peruñcellūr village ; pupil of Dāmodaran Nampūtiri of Maṅgalaśśeri house.

—*Bhadradīpagaṇita* (Mal.)

—*Bhūgolañāyam* (Mal.)

Ref. See above, p. 66, § 43 ; Ul. III. 232-34 : Ul. Sup. I. 534.

Iñcakkāzhvā Mādhava : See under Mādhava II.

Uccanīcādigaṇita (kar.), (Mal. prose).

Ms. 13194-B.

Uccādibalānayanam (kar.), (Mal. prose).

Ms. C. 2197-E.

Uḍugaṇaphalam (astrol.), Anon.

Ms. 3671-F.

Do.—C (Mal.), Anon.

Ms. 3671-F.

Uḍujātakodaya (jā.), Anon., (Ker. ?).

Beg. gaṇeśavāgdaivataviṣṇuśaṅkarān
inendubhaumajñagurūśanaśśanin /

Uḍujātakodaya (contd.)

> praṇamya pātoccagṛbāṁśca sadgaṇān
> udāhariṣyāmy Uḍujātakodayam //

Mss. 1004-A, 10627-B, 13478-G, C. 1912-D, CM. 118-E, L. 690-D, L. 864-B, P. 876-I, P. 900-B.

Do.—C (Mal.), Anon.

Ms. 1004-A, 10627-B, CM. 118-E, P. 876-I, P. 900-B.

Udayadivākara (Ker. ?), (before, A.D. 1073, his epoch).

—C on an unidentified work of Jayadeva.

—C *Sundarī* on *Laghubhāskarīya* of Bhāskara I.

Ref. See above, pp. 45-46, § 8; K. S. Shukla, 'Jayadeva, the mathematician', *Gaṇita*, (Lucknow), 5 (1954) 1-20.

Uparāga- : See also under *Grahaṇa-*.

Uparāgakriyākrama I (ecl.), by Acyuta Piṣāraṭi, A.D. 1592, in 4 chs., 175 gr.

Mss. See *Ker.*, I. p. 100. Ref. Ul. II. 323.

Do.—(Mal.), Anon., 425 gr.

Beg. gurūṇām caraṇāmbhoja etc.; tithiye pratykṣamākkinṭa pramāṇam.

Mss. 404-B, 13389-D, C. 173-E, C. 531-B, C. 628-B, C. 541-C; Mad. Mal. D. 216. Ref. Va. II. 682-83 (where it is wrongly described as the com. Nārāyaṇa's *Uparāga°*).

Do.—C (Mal.), *yukti* of certain sections, Anon.

Ms. With K.V. Sarma.

Uparāgakriyākrama II (ecl.), by Nārāyaṇa, in 5 chs., 300 gr.; epoch A.D. 1561.

Mss. See *Ker.*, I. p. 100; Mad. Ref. Sen., p. 150; Ul. II. 121; Ul. Sup. I. 222; Va. II. 683.

Do.—C (Mal.), Anon. (300 gr.).

Ms. 770-B; C. 531-B. Ref. Va. II. 683-84.

Uparāgakriyākrama III (ecl.), Anon., acc. to Nīlakaṇṭha Somayāji.

Beg. puṣpavantau namaskṛtya 'Nīlakaṇṭhokta-vartmanā' / anyo vilikhyate kaścid Uparāgakriyākramaḥ //

Ms. 5862-C. Ref. Ul. Sup. I. 222-23.

Uparāgaviṁśati (ecl.), Anon., 60 gr., by Acyuta Piṣāraṭi (?)

Beg. puṇyaghnāt khaṇḍaśeṣād vitatha-hṛtalavādy ūnitaḥ khaṇḍa-śeṣo.

Ms. Trippunithura Skt. Col. 1075. **Edn.** Rama Varma Maru Tampurān, *Śrī Ravi Varma Skt. Granthāvali,* (Trippuni-thura), 2 (1954) i-iii, 16 pp. **Ref.** Ascription of authorship, on the authority of Puliyoor Purushottaman Nampūtiri, Intro., to the *Sūryasiddhānta,* (Trivandrum, 1125 M.E.), p. x.

Do.—C (Mal.), Anon.

Beg. sūryagrahaṇam tān somagrahaṇam tān raṇṭālonnu.

Ms. Trippunithura Skt. Col. 1075. **Edn.** Rama Varma Maru Tampurān, with text, above.

Uparāgāṣṭaka (ecl.), Anon., 20 gr. Epoch : Kali 1703,790, A.D. 1563 :

Beg. 'nālosau gānasampad'-virahitadivasād.

Mss. 5817-A, C. 173-K.

Do.— C (Mal.), Anon.

Beg. anantaram Uparāgāṣṭakattinṭe bhāṣa camakkunna ācāryan sūryendukkaḷuṭe grahaṇatte ... nālosau.

Ms. C. 173-K.

Do.—C (Mal.), Anon., 175 gr.

Beg. anantaram sūryacandranmāruṭe grahaṇatte gaṇikkum pra-kāram collunnū—nālosau.

Ms. 5817-A.

Ṛtūtpattiphalam (astrol.), Anon., 30 gr.

Beg. sūrye vyādhisamṛ...somavāre patipriyam /
(bhaume) duḥkham avāpnoti budhe putrasamāgamam //

Ms. PM. 4077-E.

Ekaviṁśatipraśnakrama (arith.), Anon., (Mal.).

Beg. yaḥ sūryācandranetraḥ saridadhipasutātuṅgavakṣojalagnaiḥ

Ms. C. 541-D. **Ref.** Ul. III. 239-40.

Eñcuvaṭi (arith.) (Mal.), Anon.

Mss. See *Ker. Mal.,* pp. 23-24.

Eṭakkaṭṭu Kukkaṇiyāl : *See under* Iṭakkāṭṭu Kukkaṇiyāl.

Kakṣyādi-sphuṭa-gaṇitam (?) (kar.), (Mal.), Anon.

> Ms. 151-D (inc., 70 gr.).

Kakṣyāpratimaṇḍalādi-śloka-yukti (on *Āryabhaṭīya,* Kāla., 17-21), (astron.) Anon., 135 gr.

> Beg. atha sūryendvor madhyamāt sphuṭasya mandaphala-saṁs-kārād bhedo bhavati / kujādīnām etc. / tatra pratimaṇḍala-kalpanām sārdhābhyām aryābhyām kathayati—kakṣyāprati-maṇḍalagā etc. /

> Mss. 8358-F ; IO. 6301 (*Golasāra* etc.), ff. 4b-11b.

Kaṭapayādi-saṅkhyaḥ (astron.).

> Ms. Ad.

Do.—C, Anon.

> Ms. Ad.

Kaṇakkatikāram (arith.), (Old Mal.), Anon.

> Beg. paṇakkarinākamīṭum paṭarcaṭaiccivanu polum piṇakkarutāta celvam peruma cernnoḷiviḷaṅkum / Kaṇakkatikāram ennum kavita kaṭṭiyampuvānāy tuṇaikka nalkarimukatton tuyarkeṭatteḷintu vante //

> Mss. See *Ker. Mal.,* p. 25. Ref. Ul. II.478. See also *Gaṇitanūl* to which this work seems to be related textually.

Do.—C (Mal.), Anon.

> Mss. See *Ker. Mal.,* p. 25.

Kaṇakkucodyam (arith.), (Mal.), Anon., 15-16th cent.

> Ref. Ul. II. 480.

Kaṇakkuśāstram I (arith.), (Mal.), by Kṛṣṇadāsa (Koccu-kṛṣṇan Āśān).

> Ref. See above, pp. 74-75, § 65 ; Ul. III. 524.

Kaṇakkuśāstram II (arith.), (Mal.), Anon.

> Ref. Ul. II. 479-80.

Kaṇakkusāram I (arith.), (Mal.), by Nīlakaṇṭha, 16-17th cent. (?) 1250 gr.

Kaṇakkusāram I (contd.)

Beg. eṇāṅkaśekharasutam gaṇanāthameṭṭam
vandiccu vaṇiye vaṇaṅṅi harim gurum ca /
nānāmunīn tozhutukoṇṭu Kaṇakkusāram
nere cameppatinu sāmpratam ārabhe ñān //

Mss. C. 2085-C ; CM. 630. Ref. Ul. II.478-79 ; Ul. Sup. I. 226-
27 ; Va. IV. 276.

Do.—C (Mal.), by the au. himself.

Ref. Ul. II. 478-79.

Kaṇakkusāram II (arith.), (Mal. verse), Anon.

Ms. T. 874.

Do.—C (Mal.).

Ms. T. 874.

Kaṇṇaśśappaṇikkar

— C (Mal.), *Horāphalaratnāvali* on *Horā*, (apocryphal).

Karaṇam (?) (kar.), Anon., epoch A.D. 1734, 75 gr.

Beg. 'calanastutisaṅkhy'onam divasagaṇam dhidaśodhanaiḥ kulī-
nāṅgaiḥ.

Ms. C. 2470-C.

Karaṇadarpaṇam (kar.), by a Bhāradvāja brāhman.

Beg. haripādāmbujam natvā Bhāradvājo dvijottamaḥ /
laghupūrvasphuṭopāyam vakṣye Karaṇadarpaṇam //

Mss. 597-D, 12367-D, E.

Do.—C (Mal.), Anon.

Mss. 597-D, 12367-D.

Do.—C (Mal.), Anon.

Beg. taveghnādi-khaṇḍaśeṣatte tāpam koṇṭu guṇiccu sudevanek-
koṇṭu hariccāl varunna phalam rāśi.

Ms. 12367-E.

Karaṇapaddhaṭi (kar.), by Putumana Somayāji of Śivapura (Trichur),
10 chs., 300 gr.

Mss. See *Ker.*, I. p. 120 ; Ad., Mad., *NCC* I. 174. Edn. *TSS*,
No. 126 ; *Gov. Or. Ser., Madras,* No. 98, with two Mal. C-s.

Ref. Raja, 164 ; *Sen,* pp. 104-5 ; Ul. II.107-8 ; Va. I, 529-31.

Karanapaddhati (contd.)

Do—C I (Mal.), Anon.

> **Beg.** Nūtanagṛha-Somasutā...... / avite ācāryan prabandhatte camappān tuṭaṅṅunneṭattu...

> **Mss.** See Intro. to Madras edn. ; **Edn.** See above.

Do—C II (Mal.), Anon.

> **Beg.** Nūtanagṛha-Somasutā ... / Karaṇapaddhatiyākunna granthatte camappān tuṭaṅṅunna ācāryan...

> **Mss.** See Intro. to Madras edn. **Edn.** See above. **Ref.** Ul. III. 238-39.

Do—C III (Mal.), *Śakābdasaṁskārakriyā*, on verses I. 12-13, Anon., 100 gr.

> **Ms.** 5820-C. **Edn.** App, pp., 307-11, to the Madras edn., above.

Karaṇasāra (kar.), by (? Śaṅkara Vāriyar), pupil of Nīlakaṇṭha Somayāji and Dāmodara ; 4 chs., 135 gr. Epoch : *anūnajñānasādhya*, Kali day 17,00,000, A.D. 1553.

> **Beg.** ābhāṭyadvayadantādhyam... (1); jayanti mānsāṁbhoja... (2); Śrī-Nīlakaṇṭham ācāryam Śrīmad Dāmodaram gurum / praṇamya likhyate kiñcid gaṇitam sulaghukriyam //

Do—C (Mal.), *Kriyākrama* by Śaṅkara Vāriyar.

> **Mss.** C. 8-B, C. 173-J. **Ref.** Ul. II. 474.

Karaṇāmṛta (kar.), by Citrabhānu, A.D. 1550, 4 chs., 120 gr.

> **Mss.** C. 1380 A, B ; T. 734 ; *NCC* I. 176.

Do.—C I Anon., 900 gr.

> **Beg.** śivam dadyācchivo mahyam etc. // tatrādau tāvad Ācāryaḥ Karaṇāmṛtam nāma prakaraṇam cikīrṣuḥ....

> **Mss.** C. 1380-B, T. 734.

Do.—C II, Anon., 1000 gr.

> **Beg.** śivam dadyāc chivo mahyam etc. / vāgīśvarīm praṇamyāham gurumścārkādikān grahān / prārabhe Citrabhānūktam vyākhyātūm Karaṇāmṛtam //

> **Ms.** C. 1380-B.

Karaṇottama (kar.), by Acyuta Piṣāraṭi, 5 chs., 150 gr.

    Mss. See *Ker.*, I. p. 120 ; Mad. ; *NCC* I. 175. Ed. *TSS*, No. 213.
    Ref. Ul. II. 323-24.

Do.—C I by the au. himself, 400 gr.

    Beg. atha iṣṭadevatānamaskārapūrvakam cikīrṣitam pratijāṇāti—
        praṇipatya etc.

    Mss. See *Ker.*, I, p. 120 ; Mad. ; *NCC* I. 176. Edn. *TSS*, No. 213.

Do—C II (Mal.), Anon., by a Kerala brāhman.

    Beg. anantaram Karaṇottamattinṭe bhāṣayuṇṭākkuvān tuṭaṅ-
        ṅunnū.

    End : Acyutan tān camacculla Karaṇottamakasya tu /
        bhāṣāvyākhyānam uṇṭakkī Keralīyo dvijottamaḥ //

    Ms. with K.V. Sarma.

Karmadīpikā I **:** Name of C by Parameśvara I on the the *Mahā-
bhāskarīya* of Bhāskara I.

Karmadīpikā II **:** Name of C by Nārāyaṇa I on *Līlāvatī* of
Bhāskara II.

Kalidinādigaṇitam (?) (kar.), (Mal.), Anon., 140 gr.

    Beg. dhījagnnūpuram koṇṭu kalyabdattep perukkiyāl /
        tatsamena haricculla phalaṅṅal divasaṅṅalām //
    Ms. 11064-A.

Kālacakradaśānayanam (jā,), Mal. prose, Anon., 20 gr.
    Ms. 3631-D.

Kālacakradaśānirṇaya (astrol.). **Ms.** L. 336-F (inc.)

Do.—C (Mal.). **Ms.** L. 336-F (inc.).

Kāladīpa (astrol.), by Vāsudevasvāmi.

    Beg. vande'mbujaprabhākṣam mābhūbhyām cārutaram yutam /
        lasannāge'śucan saktam amlānam kṣaravarjitam //
    Mss. L. 1379-C, D ; Mad. R. 5158 (b). **Ref.** Va. III. 392-94.

Do.—C. by Śyāmalavāraṇarāja, a prince.

    Mss. L. 1379-C ; Mad. R. 5158 (b). **Ref.** Va. III. 392-93,

Kalādīpaka I (muh.), by Śaṅkaran of Nampūtiri of Mahiṣamaṅgalam.
I : shorter version (Mal. title : *Ceṟiya Kālādīpakam*).

Mss. See *Ker. Mal.*, pp. 29-31.

Do.—C I (Mal.), Anon. Mss. 151-C, 935-D, 19842-B.

Do.—C II (Mal.), Anon., 850 gr. Ms. 3630-C.

Kalādīpaka II (muh.), by Śaṅkaran of Nampūtiri of Mahiṣamaṅ-
galam : II. Longer version (Mal. title : *Valiya Kālādīpakam*).

Mss. See *Ker. Mal.*, pp. 31-32. Edn. With auto-com , See below.

Do.—C *Balaśaṅkaram* (Mal.), by the author himself.

Mss. See *Ker. Mal.*, p. 32. Edn. *Sri Vanchi Setu Lakshmi Series*,
Nos. 6, 13, 15, Trivandrum.

Kalādīpika (astrol.), Anon.

Ms. Vaṭavarkkoṭṭu Mana, Venkitangu, List I, 14.

Do.—C (Mal.), Anon. Ms. Vaṭavarkkoṭṭu Mana, Venkitangu,
List I, 14.

Kalaprakaśika (astrol.), (Mal.), Anon., pupil of Pūrṇaprabodha ;
2 pts., 340 gr.

Beg. arkabimbamakame vasiccukoṇṭ ittrilokamatil ātmatejasā /
satkriyādyakhilakālabodhadam cakrapāṇiye vaṇaṅṅiṭunnu ñān //

Pūrṇaprabodha-mukhasadguṇa-madgurūṇām
pūrṇaprasāda-paramāśrayavaibhavena / ... ... /
bālaprabodhamatiṅāy adhunā Muhūrta-
Kālaprakāśika curukkiyatāy camappān //

Mss. 12686-E ; Pāliyam List, 621.

Kalārpaṇam : See *Laghukālārpaṇam*.

Kujādipañcagraha-mahāvakya or *Samudravākya* (kar.), (Ker. ?)
2075 mnemonic sentences of the cyclic tables of planets,
Anon. 750 gr.

Mss. See Intro., pp. v-vi of *Vakyakaraṇa*, ed. T. S. Kuppanna
Sastri and K.V. Sarma, K. S. R. Inst., Madras, 1962 ; L.
893-A, T. 510 ; Edn. *Ibid.*, App. III, pp. 135-249. Ref. For
their application in the computation of true planets, see
ibid., Intro., pp. xvii-xx ; 258-60.

Kujadisphutaganitam (kar.), (Mal.). Ms. 151-D.

Kujadisphutasamskarah (kar.), Anon. Ms. 14039-A.

Do.—C (Mal.), Anon. Ms. 14039-A.

Kuttakaradiganita (math.), Anon., 350 gr.

Beg. atha kuttakaradikriyam aba.

Ms. 14076-D, L. 1337-B.

Kumara-ganaka, (14th-15th cent.), a protege of Devasarma, br. of Govinda, possibly of the royal brahman family of Ampalappuzha.

—*Ranadipika.*

Ref. See above, p. 50, § 20 ; Ul. II. 112-13 ; Va. II. 725-29.

Krsicakrannal (nat. astrol.), (Mal.), Anon.

Ms. 10856-G (with diagrams).

Krsna I or Krsnacarya, (c. 1200), an early and highly popular author q. by Govinda Bhatta (1237-95).

—*Cintajñana* or *Krsniya*

—C *Krsniya* on *Hora*

Ref. See above, p. 47, § 12 ; *Ul.* I. 169-70.

Krsna II, (diff. from Krsnadasa, below).

—C (Mal.) on *Aryabhatiya*

Ref. See above, p. 70, § 53.

Krsnadasa (Krsnan Asan or Koccu-Krsnan Asan), (1756-1812), of Netumpayil house near Tiruvalla.

—*Kanakkusastra* (Mal.)

—*Pañcabodha VIII* (Mal.)

C (Mal.), *Dasagitisutram-bhasa* on *Aryabhatiya, Gitika-pada.*

—C (Mal.), *Bhasajatakapaddhati* on the *Jatakapaddhati* of Paramesvara

Ref. See above, p. 74-75, § 65 : Ul. III. 519-27 ; Ul. Sup. 647-48 ; Intro. to the edn. of *Bhasa-jatakapaddhati.*

Krsnan Asan : *See* Krsnadasa.

Kṛṣṇa-śiṣya, (c. 1200).

—Praśnaphalaprāptikālantrṇaya

—C on Hora

Ref. See above, pp. 47-48, § 13.

Kṛṣṇiya or *Cintajñāna* (astrol.) : See *Cintājñāna.*

Keralajyotiṣa (astrol.), by Acyuta I : See under *Devakerala.*

Kerala-dvādaśabhāvaphalam I (astrol.), Anon., (Ker. ?), in verse.

Beg. lagnādhipo vā jīvo vā śukro vā yadi kendragaḥ /
tasya putrasya dīrghāyur dhanavān rājavallabhaḥ //

Ms. 4853-B (inc., only 10 of the 11 sns.).

Kerala-dvādaśabhāvaphalam II (astrol.), (Ker.?), Anon., in prose, apparently a prose redaction of the above work. **Ms.** 4854.

Kerala-dvādaśabhāvavākyāni (astrol.), (Ker. ?) by Vararuci, 12 chs., in prose, 150 gr.

Beg. Kerala-dvādaśabhāvavākyāni likhyante. dehasthānādhipaḥ ṣaṣṭāṣṭama-vyaya-sthānādhipaś cet dehasaukhyam bhavati.

Col. Iti Keralīya-Vararucivākye ... ... dvādaśodhyāyaḥ. Kerala-Vararuci-prokta-Bhāvaphalam.

Ms. 4853-A. **Ref.** Ul. Sup. I. 228.

Kerala-Nāḍīgrantha (astrol.), by Keralācārya. **Men.** Va. IV.255.

Keralanirṇaya or *Jātakarahasya* : See under *Vararuci-kerala.*

Kerala-Praśnasāra (pra.) by Keralācārya.
Men. Va. IV. 255.

Kerala-rahasya by Acyuta I : See *Devakerala.*

Kerala-saṁhitā (nat. astrol.), by Keralācārya.
Men. Va. IV. 255.

Keralācārya, (12 cent. ?), of the Kāśyapa gotra, native of Trichur ; said to be an authority on Jyotiṣa and Āyurveda and minister of the Kerala king Rāma Varmā (?). Or, is he only an apocryphal author ?

Keralācārya (cont.)

—*Kerala-nāḍīgrantha*

—*Kerala-Praśnsāra*

—*Keralīya-Praśnamārga*

—*Keralasaṁhitā*

Ref.   See above, pp. 46-47, § 10 ;   Ul. I.164 ;   Va. IV. 255-56.

Keraliya-dvija, real name not known.

    —C (Mal.) on *Karaṇottama* of Acyuta Piṣāraṭi.

Ref.   See above, p. 70, § 54.

Keralīya-Praśnamārga (pra.), by Keralācārya.

Men.   Va. IV. 255.

Koccu-Kṛṣṇan Āśān : *See* Kṛṣṇadāsa.

Kriyākramakarī, names of two commentaries, both by Nārāyaṇa,   on the *Līlāvatī* of Bhāskara II.

Kriyāsaṅgraha I (kar.), Anon., in six sns., on the   computation of *śraddha, sthālīpāka, kalyabdādi, cakrārtha, chāyā* and *grahaṇa,* 300 gr.

Beg.   śraddhāpurassaram natvā grahān api gaṇeśvaram /
          śrāddhacandrādigaṇana-Kriyāsaṅgraha ucyate //

Mss.   C. 621-D, C. 2470-D.   **Ref.**   Va. II. 685-86.

Do.—C I, *Kriyāsaṅgrahakriyāmārga,* Anon., 1650 gr.

Beg.   gurudhyānena sambandhahṛdayāmburuham mayā /
          Kriyāsaṅgraha-samproktam kriyāmārgam vilikhyate //

Mss.   1093, 12804-B, T. 139, T. 140-A.

Do—C II (Mal.), Anon.   **Ms.**   844-D.

Kriyāsaṅgraha (?) II (kar.), (Mal.), Anon.

Beg.   candrārkayoge nālañcu patinonniha pattapi /
          rāśi vannāl annu cintyam lāṭavaidhṛtadoṣakau //

Ms,   T. 140-B (inc., 500 gr.).

[*Kṣudrapraśna* (pra.)]

    —C (Mal.), Anon., 70 gr.   **Ms.**   10512-C-3.

Khaṇḍajyādi (kar.), miscellaneous sine tables etc., Anon.

Ms.   L. 1242-B (120 gr.).

Khaṇḍadhruvādyānayanam (kar.).

Ms. C. 2197-K, L. 1221-C (70 gr.),

Khaṇḍadhruvānayanam I (?) (kar.), (Mal.), Anon.

Beg. ini dṛkkile khaṇḍavam dhruvavum uṇṭākkum prakāratte collunnū.

Ms. L. 1221-C-1 (18 gr.)

Khaṇḍadhruvānayanam II (?) (kar.), (Mal.), Anon., 45 gr.

Beg. iṣṭadivasatte kali vaccu amitayavotsu a ennu vāṅṅi ...

Ms. C. 2197. /

Gaṇanakriyādi (?) (kar.), (Mal. verse), Anon. **Ms** CM 530-D.

Gaṇita : See also under *Grahagaṇita, Grahaṇagaṇita, Candracchāyāgaṇita, Chāyāgaṇita, Vyatīpātādigaṇita* etc.

Gaṇita I (?) (kar.), Anon., Misc. calculations and tables.

Ms. 333-B (200 gr.).

Gaṇita II (?) (kar.), misc. calculations and tables. **Ms** 1170-B (200 gr.)

Gaṇitakrama, (kar.), Anon. **Mss.** Cranganore Palace, 65, 177.

Gaṇitakriyā (?) (kar.), Anon., misc. computations; epoch A.D. 1527.

Beg. 'dhīpatirnalatuly'onam śivadūtāhatam dinam.

Ms. C. 531-C (inc., with C, 500 gr.). C. 1954-I (inc., 210 gr.).

Rem. Some of the procedures have been adapted from the *Veṇvāroha* of Mādhava.

Do.—C (Mal.), Anon. **Ms.** C. 531-C (inc., 500 gr. with text).

Gaṇitagrantha I (kar.), by Panakkāṭ or Iṭakkāṭ Nampūtiri, A.D. 1671. **Mss.** Not identified. **Ref.** Ul. III. 88 ; Va. III. 401.

Gaṇitagrantha II (kar.), by Putumana Somayāji (?)

Beg. madīyahṛdayākāśe cidānandamayo guruḥ /
udetu satatam samyag ajñānatimirāruṇaḥ //
pātonāt svamṛdusphuṭād bhujagaṇaḥ kṣiptāntyayā taḍitaḥ

Ms. Mad. R. 5151 (c).

Ganitagrantha II—C. Anon.

End : asyārthaḥ—kujasya dve kale madhyama-bimba-kalāmānam /
budhasya tisraḥ kalāḥ / guros sārdhās tisraḥ / śukrasya
catasraḥ kalāḥ / śaneḥ dve kale, daśa vikalāś ca hi (?) /
tā vyāsārdhahatāḥ svacaturdha-karṇahṛtād bhaumādīnām
sphuṭabimba-kalāmanāni syuḥ //

Ms. Mad. R. 5151 (c).

Ganitadarpaṇa, (? *Siddhāntadarpaṇa*) (siddhānta), by Nīlakaṇṭha
Somayāji, 45 gr.

Ms. *List of mss. collected by the Curator for the Pub. of Skt.*
mss., Trivandrum, App. to the *Annual Adm. Rep of the*
Travancore State, M.E. 1104, no. 75.

Ganitanūl (arith.), (Old Mal.), Anon.

Beg. Maṇi nī keḷ pūmitoyavāyuvākāśam ennum
maṇitikeḷanattamāti arimporuḷakinnu /
tuṇayillātoruvan tanne tozhutu ñān
talanīrkkoṇṭa Gaṇitanūl atinecconnān //

Ms. CM. 566-A. **Rem.** This work is related to *Kaṇakkatikaram*,
textually.

Ganitanyayasaṅgraha : See *Yuktibhāṣā*.

Ganitam Bhāṣā I (astron.), (Mal.), Anon., 500 gr.

Beg. Gīrnaḥ śreyaḥ ... ...

End divasāgararatnāni deśāntaraviliptikāḥ /
ādityacandratuṅgāṇam vikalādi puroktavat //
Gaṇitabhāsā samāptā.

Ms. 935-C.

Ganitam Bhāṣā II (astrol.), (Mal.), Anon.

Beg. sāyanārkaneyeṇṇunna prakāram atha collinen /
antikkekku gaṇikkeṇam śrāddham samśayamākilo //

Ms. 12367-C.

Do.	III : Mss.	1416-E (verse, inc., 450 gr.)
Do.	IV : ,,	5076-B (mixed, inc., 4800 gr.)
Do.	V : ,,	5109-B (prose, inc., 80 gr.)
Do.	VI : ,,	5815 (mixed, inc., 400 gr.)
Do.	VII : ,,	5820-B (mixed, inc., 240 gr.)

Gaṇitam Bhaṣā (contd)

Do. VIII : „   12367-C (mixed, inc , 225 gr.)

Do. IX : „   T. 149 (mixed, inc., 1000 gr.).

Do. X : „   T. 251-A (mixed, inc., 230 gr.)

Do. XI : „   T. 897 (mixed, inc., 700 gr.)

Do. XII : „   PM. 4345-B (mixed, inc., 19 gr.)

On the above See *Ker. Mal.*, pp. 47-48.

Do. XII (kar.), Anon. ; epoch : Kali 16,89,131, A.D. 1523.

Beg. 'paulastyadhirhitāy'onita-kalidivase   prastragorājyabhakte etc. ; dhanyā ramā sā etc. ; koļambam taraļāṅgāḍhyam etc.

Ms. PM. 4043-B.

Gaṇita-yuktayaḥ (astron. rationale), by a Bhāradvāja brāhman.

Beg. viditvāryabhaṭaprokia-golatattvena kenacit /

Bhāradvājena tanyante kaścid gaṇitayuktayaḥ //

Mss. 755 ; Mad. Mal. D 339, pp. 83-89 ; Crangannore Palace, no. 242.

Gaṇita-yukti (math.-astron. rationale).

Beg. vande gaṇḍataṭasravanmadadhunī etc.

gurupādāmbujam natvā dhyātvā sāmbaśivam mayā / likhyate gaṇitam kṛtsnam grahagatyupayogi yat //

Ms. Mad. R. 4382. **Ref.** For Mal. version, see *Yuktibhaṣā* ; Ul. III. 440 ; Ul. Sup. I. 616.

Gaṇitavākyāni (kar.), Anon. **Ms.** L. 893-A.

Gaṇitasaṅgraha : Alt. title for Pt. I of *Jyotiśśāstrasaṅgraha* of Azhvāñceri Tamprākkaļ.

Gaṇitasāra I (kar.), (Mal.), Anon.

End. of Ch. I : tekkum kollattu vāṇijyā agnindhram tiruvallabhe / ...tatra tatra tu keṭṭiṭṭu pūrvācāryoktam ācaret //

Ms. PM. 4158-A.

Gaṇitasāra II or *Pañcabodha-Gaṇitasāra* (kar.), (Mal.), by Śaṅkaran Nampūtiri of Mahiṣamaṅgalam, in 8 chs., 1550 gr.

Mss. See *Ker. Mal.*, p. 48. **Men.** Ul. II. 472.

Ganitasūcika, by Govinda Bhaṭṭa (?), in 6 chs.

> **Ms.** Q by Va., but said to be missing ; possibly a fictitious work.
>
> **Men.** Va. I. 530, III. 390.

Garbhalakṣaṇam (astrol.), (Skt.-Mal.), Anon.

> **Beg.** ini ippol garbham uṇto ennaṟivān collunnu. lagnārūḍhaṅ-ṇaḷil tān etc.
>
> **Ms.** C. 565-E.

Gīrnaḥ śreyādi-Candavākyāni or *Vararuci-vākyam* (Moon mnemonic table) by Vararuci I.

> **Mss.** See *Ker.* I. 212-14 (*Candravākyam*). **Edn.** *Candarvākyas* of Vararuci, Adyar, 1948 ; App. II, pp. 125-34 to the edn. of *Vākyakaraṇa*, Madras, 1962.

Guṇakārādipramāṇa (kar.), (Mal., prose), Anon. **Ms.** 4124-B.

Gurumandādijyaḥ (kar.), (Mal). **Ms.** 13445-B.

Goda Varmā. **Ref.** See above, p. 78, § 75.

Goladīpikā I (spherics), by Parameśvara of Vaṭaśreṇi, A.D. 1443, 4 chs., 300 gr.

> **Beg.** vande kiśoram pārvatyā aṅkasaṁstham gajānanam /
>
> stanyapānaratam kalpadrumasyādho vināyakam //
>
> **Mss.** See Intro., p. 9, to edn. ; **Mad. Ed.** with auto-com. and Tr., by K.V. Sarma, Adyar Library, Madras, 1957.

> **Do.**—C *Vivṛti* by the author himself. **Mss.** See Intro , p. 10, to edn. ; **Mad. Edn.** K.V. Sarma, Adyar Library, Madras, 1957.
>
> **Ref.** Va. IV. 223-24.

Goladīpikā II (spherics), by Parameśvara of Vaṭaśreṇi, 302 āryā verses in one sequence.

> **Beg.** vighneśvaram vāgdevīm gurūn dineśādikān grahān /
>
> vakṣye bhūgolam asmai kṣoṇimānādikam ca laghumataye //
>
> **Mss.** See Intro. to edn. **Edn.** *TSS* 49. **Ref.** Ul. II. 322-23, where it is wrongly described as the work of Acyuta Piṣāraṭi.

Goladīpika III, (spherics), by Parameśvara of Vaṭaśreṇi. A highly expanded version of *Goladīpika* II. **Ms.** IO 6297.

Golavīda (spherics) by Mādhava of Saṅgamagrāma.

Ms. Elaṅkunnappuzha Kovilakam List, 20. **Ref.** On the loss of this ms., see note by K. V. Sarma, *Mathrubhumi Weekly*, (Mal., Kozhikode), 17.6.1956, p. 4.

Golasaṁsthānam (spherics), Mal. verse, Anon.

Beg. ādityāstamayodayaṅṅaḷil vidhau śṛṅgonnatikkarkkanum / candran pāmpoṭu kālalagnavum uṭan vacciṭṭu rāśitrayam //

Ms. PM. 4186-B (100 gr.).

Golasāra (spherics), by Nīlakaṇṭha Somayāji, in 3 sns., 56 verses.

Mss. See Intro., pp. viii-xi to edn. ; Mad. **Edn.** and Tr. by K.V. Sarma, V.V.R.Inst., Hoshiarpur, 1970.

[*Golādhyāya* (astron.), of Bhāskara II]

—C by Vidvān Iḷaya Tampurān of Koṭuṅṅallūr.

Men. Ul. IV. 34 ; Va. IV. 318 ; RNP IV. 400.

Do.—C *Jyotiṣaprakaśanam*, by Rājarāja Varmā Koyittampurān.

Ms. C. 719.

Govindakṛti (astron.), by Govindasvāmin.

Rem. Known through qns. in the works of Śaṅkaranārāyaṇa (C on *Laghubhāskarīya*, under II.3, IV. 9, VIII. 18), Nīlakaṇṭha Somayāji (*Āryabhaṭīya-bhāṣya*, Gaṇita. 4, 33) and Nārāyaṇa (C *Kriyākramakarī* on *Līlavatī*, I. *Trairāśika*, 3 etc.

Govinda Bhaṭṭa

—*Gaṇitasūcikā*.

Men. Va. I. 530, III. 390.

Govinda Bhaṭṭatiri of Talakkuḷam, (1237-95).

—C *Daśādhyāyī* on *Horā*

—*Muhūrtapadavī* I

—*Muhūrtaratna*

Ref. See above, p. 49, § 17 ; Raja, 132-33 ; Ul. I. 167-69 ; Va. I. 353-59, II. 499-500 ; Koṭṭārattil Śaṅkuṇṇi, *Aitihyamāla*, Pt. I, (6th edn., Trichur, 1961), pp. 99-108.

Govindapaddhati (astrol.), by Govindasvāmin.

Ref. by Nīlakaṇṭha Somayāji in his *Grahaṇādigrantha*, ms., p. 44 ; Raja, 127.

Govinda Piṣāraṭi of Kailāsapuram house, in Vaikkom, teacher of the anon. com. on Parameśvara's *Jātakapaddhati.*

Ref. See above, p. 70, § 55.

Govindamaṅgalam Nampi, (15th-16th cent.), teacher of Mādhava of Īñcakkāzhvā (au. of *Praśnasāra* I).

Govinda-śiṣya, real name not known ; native of Vaikkom.

— C on the *Jātakappadhati* of Parameśvara I.

Ref. Ul. III. 89-90 ; Ul. Sup. I. 464 ; Va. III. 382-83.

Govindasvāmin, (c. 800-850), teacher of Śaṅkaranārāyaṇa who was court-astronomer of King Ravi Varmā at Mahodayapuram, the then capital of Kerala.

　　—*Govindakṛti*

　　—*Govindapaddhati*

　　—C *Prakaṭartha* or *Sampradāyapradīpikā* on *Paraśarahora*

　　—C *Bhāṣya* on the *Mahābhāskarīya* of Bhāskara I

Ref. See above, pp. 14-15 ; 44-45, § 6 ; T.S.K. Sastri, Intro., pp. xlvi-1 of his edn. of the *Mahābhāskarīya,* (Madras, 1957) ; Raja, 127-28 ; Ul. II. 96-97.

Gauliśāstram (nat. astrol.), (Mal.), by Rāma Vāriyar of Kaikku-langara. **Ref.** See above, p. 80, § 81.

Grahakarmasaṅgraha (astron.), Anon., 60 gr.

Beg. golam jyotirmayam natvā granthair pūrvakṛtair api / karomi bālabodhārtham Saṅgraham Grahakarmaṇām //

Mss. 1025, 1050.

Do.—C, Anon., 300 gr. **Ms.** 1050.

Grahagaṇitam (?) I (kar.), (Mal. verse), Anon　　**Ms.** 13034 (80 gr.)

Do.	II :	Ms.	13057-B (verse, 200 gr.)
Do.	III :	,,	13073-C (with Mal. C, 75 gr.)
Do.	IV :	,,	13136-D (verse, 40 gr.)
Do.	V :	,,	13149-J (verse, 95 gr.)
Do.	VI :	,,	13194-C (verse, 350 gr.)
Do.	VII :	,,	13294-V (mixed, 100 gr.)
Do.	VIII :	,,	C. 555-A (verse, 500 gr.)
Do.	IX :	,,	L. 336-A (verse, 500 gr.)

Grahacakralekhanavidhi (astron), Anon. Ms. 12999-S.

Grahacāra I (kar.), Tables for the day-to-day reading of the planets.

   Ms. 1100. Rem. For the years A D. 1845-55.

Grahacāra II (kar.), Tables for the day-to-day reading of the planets.

   Ms. P. 873 (inc., 2000 gr.).

Grahacāra : See also *Aganita-grahacāra, Pañcāṅga.*

Grahacāranibandhanam (kar.), by Haridatta ; the source-book of

   the Parahita system of Kerala, 3 sns., 150 gr.

   Mss. See Intro., pp. x-xii, to the edn. of the work. Edn.
       K.V. Sarma, K.S.R. Institute, Madras, 1954.

Grahacāranibandhana-saṅgraha (kar.), Anon. Ms. See Intro.,
       p. xii, to the edn. above. Edn. K. V. Sarma, as App. to
       the edn. above.

Grahacāraphalam (astrol.), Anon., being a summary of the *Gocārā-*
   dhyāya of the *Bṛhatsaṁhitā.*

   Beg. Varāhamihireṇoktam Saṁhitāyām savistaram /
         Grahacāraphalam yat tat saṅkṣipyātha mayocyate //
         āyāso vibhavakṣayo'dhvagamanam ...

   Mss. C. 2259 C, D.

Do.—C I (Mal.), Anon,

   Beg. janmattil sūryan— āyāsam, vibhavakṣayam, sañcāram.
         rogapīḍā.
   Ms. C. 2259-C.

Do.—C II (Mal.), Anon. Ms. C. 2259-D.

Grahacāraphalādinirūpaṇam (astrol.), Anon. Ms. 865-A.

Do.—C (Mal.), Anon. Ms. 865-A.

Grahaṇa (ecl.), (Mal.) Readings of a solar eclipse in A.D. 1687.

   Beg. (8)63-ām āṇṭu tulāmāsam 24-ām tiyati sūryagrahaṇam.
        'dānto naḷo vai sevyaḥ' ka(li).

   Ms. CM. 595-I (40 gr.).

Grahaṇagaṇita I (ecl.), by Putumana Somayāji (?), in 16 verses.

Beg. madīyahṛdayākāśe cidānandamayo guruḥ /
udetu satatam samyag ajñānatimirāruṇaḥ || 1 ||

sūryendvor grahaṇam sphuṭam gaṇayitum ... (2) ; sūryendū sagatī tamaś ca... (3).

Ms. With K.V. Sarma. This work incorporates into it *Grahaṇāṣṭaka* II. The two works seem to be by the same author, who might be Putumana Somayāji, as inferred on the basis of his characteristic initial verse *madīyahṛdayākāśe* etc.

Do.—C (Mal.), Anon.

Beg. madīyahṛdayākāśa iti. iprakāram guruvine prārthiccittu sūryendukkaḷuṭe grahaṇatte arivān collunnū...

Ms. With K.V. Sarma.

Grahaṇagaṇita II (ecl), Anon.

Beg. mārtāṇḍasyoparāgam... (1) ; kṛtvā liptāsu bhedam... (2)

Ms. With K.V. Sarma.

Grahaṇagaṇita III (ecl.), Anon. ; an improvement on Acyuta Piṣāraṭi's *Uparāgakriyākrama* in 14 verses.

Beg. sūryendvor auparāgam gaṇanam abhinavam procyate 'tr-Ācyutoktāt / parvānte'rkendutuṅgād... (1).

Ms. With K.V. Sarma.

Do.—C (Mal.), Anon.

Beg. sūryendvor iti. ādityanteyum candranteyum grahaṇatte sambandhicculla gaṇanam apūrvam āyiṭṭu onnu collappeṭunnū.

Ms. With K.V. Sarma.

Grahaṇagaṇita (?) IV (ecl.), Anon., in 12 verses.

Beg. parvānte punar ūhite... (1) ; vyarkendvor bhuja... (2).

Col. iti Grahaṇakhaṇḍaḥ.

Ms. With K.V. Sarma.

Grahaṇagaṇita V (ecl.), Anon., in 10 verses.

Beg. pātārkaikya ... (1) ; vyarkendvor bhuja ... (2) ; ākṣam sundara ... (3).

Ms. With K.V. Sarma.

Grahaṇagaṇita VI (ecl.), Anon., 280 gr. ; epoch, Kali 1629048, A.D. 13:9.

Beg. 'daivajñādhiṣṭhitārko'na-dyugaṇam sthānigokharaiḥ ...

Ms. L. 1329-B.

Grahaṇagaṇita VII (ecl.), Anon. Au. same as for *Grahaṇopadeśa,* below.

Beg. māyāparvantanādivivararahitanighnāḥ dharāṇāgabhaktāḥ...

Mss. 1005-E, 12367-B.

Do.—C (Mal.), Anon.

Beg. itin poruḷ. grahaṇadivasattinnāḷe udayattinnu...

Mss. 1005-E, 12367-B.

Grahaṇagaṇita VIII (ecl.), (Mal.), Anon.

Beg. kalyabdād giriśātmabhūvininatād ā candravāroditāt.

Ms. 1187-A (cata. *Grahaṇādigaṇita*) ; Mad. D. 339 (pp. 11 ff.)

Do.—C (Mal.), Anon. Ms. 1187-A ; Mad. Mal. D. 339 (pp. 11 ff.)

Grahaṇagaṇita IX (ecl.), Anon.

Ms. 13294-D.

Do.—C (Mal.), Anon., 200 gr. **Ms.** 13294-D.

Grahaṇagaṇita X (ecl.), Mal. verse, Anon.

Beg. grahaṇam tanne eṇṇeṇṭil collunnuṇṭu curukki ñān /
rāhuketukkaḷoṭarkkan patimūnnatha tīyati //

Ms. PM. 4327-E (165 gr.)

Grahaṇanirṇaya (ecl.), by Nīlakaṇṭha Somayāji.

Ref. Q by the author himself in his *Āryabhaṭīya-bhāṣya,* (*TSS* 185, p. 102) and by others.

Grahaṇanyāyadīpikā (rationale of eclipses), by Parameśvara of Vaṭaśreṇi, in 85 verses.

Mss. 762-G ; M. S. Srinivasa Sastri, Palghat. **Edn. and Tr.** by K.V. Sarma, Hoshiarpur, 1966. **Ref.** Ul. Sup. I. 209-10.

Grahaṇaphalādi (astrol.), (Skt.-Mal.), Anon. **Ms.** 6914-B.

Grahaṇamaṇḍanam (ecl), by Parameśvara of Vaṭaśreṇi, in two versions, of 89 and 100 verses (with two addl. verses), respectively.

Ms. 339-D, 788-B, C. 166-D, CM. 333-C, L. 1248-F; with K.V. Sarma. **Edn. and Tr.** by K.V. Sarma, Hoshiarpur, 1965. **Ref.** Ul. Sup, I. 207-8.

Grahaṇādigaṇita I (ecl.), Anon.

Beg. setau gām vāturāje...

Ms. 1085-C (inc., 150 gr.)

Grahaṇādigaṇita II (ecl.), Anon.

Beg. pātāsanne kharāṁśau yadi divasaniśor dṛśā pūrṇavasāne.

Ms. 1092-F.

Grahaṇādigaṇita III (ecl.), Anon.

Mss. 12687-C (inc., 450 gr.), C. 472.

Grahaṇādigrantha (?) (ecl.), by Nilakaṇṭha Somayāji, an elaborate exposition of the tradition and rationale of eclipse computation and certain allied topics.

Ms. P. 975, latter portion; transcript with K.V. Sarma.

Grahaṇādiphalam (astrol.), Anon. **Ms.** 6914-B.

Do.—C (Mal.), Anon. **Ms.** 6914-B.

Grahaṇāṣṭaka I (ecl.), by Parameśvara of Vaṭaśreṇi.

Beg. bhāsvattuṅgau prasiddhau...

Mss. 475-K, C. 116-E, L. 1248-B-1, T. 179-B; Vayaskara Illam, Kottayam, No. 339-C; Eḷamprakkoṭṭu Mana, Eravoor, Trippunithura. **Edn.** and Tr. by K.V. Sarma, K.S.R. Inst., Madras, 1959.

Grahaṇāṣṭaka II (ecl.), by Putumana Somayāji (?), 25 gr.

Beg. sūryendvor grahaṇam sphuṭam gaṇayitum vakṣymy upāyam laghum ...

Mss. 1005-B, 5113-F, L. 1248-B-1. **Rem.** Authorship suggested on the basis of *Grahaṇagaṇita* I, which incorporates this work and has the characteristic initial verse of the Somayāji.

Do.—C (Mal.), Anon. **Ms.** 1005-B (inc., 120 gr.)

Grahaṇaṣṭaka III (ecl.), Anon., 25 gr., epoch, A.D. 1538. Exposition of a new method of Nīlakaṇṭha Somayāji.

Beg. kaṭākṣamālā yasyā hi kāmadāpi madhudviṣaḥ /
padmakiñjilkavarṇām tām namāmi kamalālayām //

matangavadanam natvā vāgdevīm ca gurūn grahān /
'Somasut'-sūtritāpūrvapakriyām vivṛṇomy aham //

Ms. 8358-H.

Grahaṇaṣṭaka IV (ecl.), unidentified.

Mss. C. 555-A, T. 323 (a few pages therein).

Do.—C I (Mal.), Anon. **Mss.** C. 555-A, T. 323 (a few pages therein).

Grahaṇopadeśa (ecl.), Anon., in 8 verses.

Beg. kāryas sūryendu... (1); māyāparvānta... (2); grāsam teṣviṣṭa ... (3).

Ms. With K.V. Sarma. **Rem.** Au. same as for *Grahaṇagaṇita* VII (?)

Do.—C II (Mal.), Anon.

Beg. grahaṇopadesattinnu collunnū— kāryas sūryendu iti. sūryagrahaṇam gaṇippān...

Ms. With K. V. Sarma. **Note.** Refers to an unidentified *Kriyā-krama*.

Grahapañcadaśaphalam (astrol.), Anon. **Ms.** P. 875.

Grahaparīkṣākrama (astron.), by Nīlakaṇṭha Somayāji. Practical directions for scanning the skies and computing the planets.

Beg. Gargādismṛtanakṣatrakṣepayogakalāgatam...

End : iti saṅkṣepataḥ proktam parīkṣā jyotiṣām iha /
kālamānacatuṣkasya śrutasya vivṛtis tv iyam //

Edn. Q. in full in the au.'s *Āryabhaṭīyabhāṣya*, under Gola. 48, (*TSS* 185, pp. 132-49).

Do.—C. (Mal.), Anon.

Beg. bhagaṇaparidhyādikaḷakunna avaṭṭinnu oro ācāryanmār ororiṭattu oro prakāram collikkiṭakkunnu.

Ms. With K. V. Sarma. **Edn.**, in an adapted form, by P. S. Purushottaman Namputiri, Astr. Res. Inst., Bombay 25, 1950.

Grahabalādyānayanam (astrol.), (Mal. prose), Anon. Ms. L. 765-B.

Grahabhāvaphala (?) (astrol.), (Mal. verse), Anon.

> **Beg.** pittam jvaram śirasi...murivum cirannum /
>
> pādakṣirogam udarasya ca raktadoṣam //
>
> rājāricoraripuśastracatuṣpadānām /
>
> kuṣṭham mahodaram apasmṛti sūryabhānau //

> **Ms.** PM. 4077-A.

Grahamadhyamānanayanam (?) (kar.), (Mal. prose).

> **Beg.** kali vaccu khaṇḍiccu raṇṭeṭattu vaccu onnine paṭu koṇṭu
> perukki...

> **Ms.** L. 765.-B (inc., 35 gr.)

Grahasamaya : See *Aṅkaṇaśāstra.*

Grahasthitiphala I (astrol.), Anon.

> **Beg.** atha grahāṇam svabalābalavaśāt jātayontibhāga (?) kriyate.
> prathamam tatra ja...yājanam āha— iṣṭakaṣṭaphala etc.

> **Ms.** CM. 565-G.

Grahasthitiphala II (?) (astrol.), Skt.-Mal., Anon.

> **Beg.** bahiṣṭhasvarkṣasaṁstheṣu nīcageṣūccageṣu vā /
> sarveṣūpacayastheṣu caturṣv ekarkṣabheṣu va //

> **Ms.** PM. 4321-B.

Grahasphuṭa I (kar.), Mal. verse, Anon.　Ms.　T. 255.

Grahasphuṭa II (kar.), Skt.-Mal., Anon. Ms. 13041-C.

Grahasphuṭaparilekhaḥ (?), (astron.), Anon., in 6 verses.

> **Beg.** draṣṭā kendrasthitaś ced ... (1) ; svoccavyāsārdhavṛttam
> prathamam abhilikhed ... (2)

> **Ms.** With K.V. Sarma.

Grahasphuṭavākyāni I (?) (kar.), Anon.　Ms. 3638-B (100 gr.)

Grahasphuṭavākyāni II (?) (kar.), Anon.　Ms. 5809 (1000 gr.)

Grahasphuṭānayana I (kar.), Mal. verse, Anon.

> **Beg.** ādityasyodayattinnum madhyāhnāntattinum tathā /
> **Ms.** T. 255 (inc., 450 gr.)

Grahasphuṭanayana II (kar.), Mal., Anon.

Beg. guṇakāraḥ kulam bhānor bhājako gotragāyakaḥ /
Ms. PM. 4331-A.

Grahāriṣṭa (astrol.), Anon. **Ms.** 13294-P.

Grahāvasthādivicāra (astrol.), Mal. verse, Anon. **Ms.** 5109-I.

Ghaṭīgopa, disciple of Parameśvara and devotee of God Padmanābha of Trivandrum, *c.* 1800.

  —C on *Āryabhaṭīya* (Skt.)
  —C on *Āryabhaṭīya* (Mal.), version I
  —C on *Āryabhaṭīya* (Mal.), version II

  Ref. See above, pp. 77-78. § 74 . Ul. III. 233-34 ; Ul. Sup. I. 535.

Caturasundarī : Name of C on *Cintājñāna*.

Candrakalānāḍī (astrol.), by Acyuta : See *Devakerala*.

Candrakriyā (kar.), Skt.-Mal. prose, Anon. **Ms.** 5806-A.

Candragaṇita (kar.), Mal. verse, Anon.

Beg. candrane sūkṣmamāyiṭṭu gaṇippān iha collinen /
    aharganatte vacciṭṭanniṣṭakalattināḳkiyāl //
    tatparāntam madhyamannaḷ varuttū candratuṅgayoḥ /
Ms. PM. 4368-G (75 gr.)

Candragaṇitakrama (kar.), (Mal.), by Śaṅkaran Nampūtiri of Mahiṣamaṅgalam.

Mss. PM. 4078-A, T. 251-B. **Ref.** Ul. II. 473.

Candragrahagaṇita (kar.), Mal. verse, Anon., 60 gr. **Ms.** L. 765-C.

Candracchāyāgaṇita I (kar.), by Parameśvara of Vaṭaśreṇi.

Beg. himaraśmicchāyāgaṇitam vakṣye hitāya daivavidām /
    Āryabhaṭa-śāstrasiddham dṛkkarmadvitayapūrvakam //
Ms. 475-I (inc., 60 gr.)

Candracchāyāgaṇita II (kar.), by Nīlakaṇṭha Somayāji.

Beg. sūryendutuṅgapātau ca tadānīm ayanāṃśakān /
    taddeśākṣam ca nirṇīya gaṇyatām śaśinaḥ prabhā //
Mss. 475 (f. 65), 5862-B, 5867 (ff. 173-77) ; Mad. R. 5185-(b)
Ref. Va. III. 391-92.

Candracchāyaganita II (contd.)

Do.—C, by the author himself.

 Ms. 5862-B (copied in Mad. R. 5185-b). Ref. Va. III. 391-92.

Candracchāyaganita III (kar.), Anon.

 Beg. nārṣā(?)lamūrtitvenūdye'tra tu... / arkendutuṅgapātau ca
nītvā kuryād...

 Ms. L. 1167-C (inc., with Mal. C., gr. 10).

Do.—C (Mal.), Anon.

 Beg. ...kal pratipadam āyi oḷa pakkaṅṅaḷe eraṭṭippatu...

 Ms. L. 1167-C.

Candracchāyaganita (?) IV (kar.), Mal., Anon., 40 gr.

 Beg. candracchāyakku collunnen tatkālārkkane veccatil /
ayanāṁśaṅṅaḷeccerttāl kūṭṭeṇam rāśiyāyatil //

 Mss. 10647-G, PM. 4329-D.

Candracchāyaganita (?) V (kar.), Mal., Anon.

 Beg. viparītacchāya veṇam candranennaṅṅirikkilo /
viṣamam punarennālum collinen oru jāti ñān //

 Ms. L. 636-C (inc., 40 gr.)

Candracchāyanayanopayaḥ (?) (astron.), Anon.

 Beg. atha pāramārthikāpakramādibhir vinā candracchāyānayane
kañcin mārgam upadiśati—

  kakhalagnapade lagnam natakālapade graham /
  akṣasthāne ca dṛkṣepam kṣepam krāntipade 'pi ca //

 Mss. C. 2314 (towards the end), C. 2470 (ff. 91b-92a).

Candranāḍi (astrol.), by Acyuta : See *Devakerala.*

Candrabhāṣa (kar.), Mal. verse, Anon., 50 gr.

 Beg. śuddhamāyi gaṇikkeṇṭū candrārkanmāre eṅkilu /
khaṇḍaśeṣam muzhuvane vaykkeṇam udayattinu //

 Mss. 4079, 4158-B, 4327-B.

Candralagnādiphala (astrol.), Mal. prose, Anon. Ms. 13475-E.

Candravākyadi (?) (kar.), Misc. mnemonic tables etc., Anon.

 Ms. L. 1229-A (1000 gr.)

Candrāvakyāni I (kar.), by Vararuci : See *Gīrnah śreyādi-Candra-vakyāni.*

Do. II : See *śīlam rajñah śriyetyādi-Candravakyāni.*

Candrasūryoparāgagaṇita (ecl.), Mal. prose, Anon. Ms. 1005-B.

Candrasputagaṇana-vākya (?) (kar.), Anon., 7 vākyas.

Ref. Below in the CC of this work.

Do.—C, in 2 verses, Anon. Men. Below in the CC of the work.

Do.—CC, Anon.

Beg. 'vākyair saptabhir' ādimair gaṇayitum candrasphuṭam yat

jyotiśśāstraviśāradena sudhiyā ślokadvayam proditam / pura

vyākhyām tasya karomy avismṛtikṛte natvā gajāsyam gurūn

sūryā — — kalāspadācchadhiṣaṇām satkālavin maṅgalān //

Ms. MC. 173-A (inc., 55 gr.)

Candrasphuṭagaṇita (?) III (kar.), Mal., Anon.

Beg. candracūḍanumāpākantanmakan gaṇanāthane /
caraticcu vaṇaṅṅiṭṭu kavimātineyum tathā //

Mss. 2243-C (under the title *Aharmānādigaṇitam*), (150 gr.),
4145-A (inc., 60 gr.)

Candrasphuṭadigaṇita I (kar.), Mal., Anon.

Beg. candrane sūkṣmamāyiṭṭu gaṇippān kriya collinen /
khaṇḍiccāl ara pokkeṇam antikkaṅṅu harikkilu //

Ms. 5811 (inc., 350 gr.)

Candrasphuṭādigaṇita II (kar.), Mal. prose and verse, Anon.

Beg. candrane sūkṣmamāyiṭṭu gaṇippān iha collinen /
aharga[ṇatte va]cciṭṭaṅṅiṣṭakālattinākkiyāl //

Ms. 14228-H.

Candrasphuṭāptih (?) (kar.), Anon., related to the *Veṇvāroha* of
Mādhava.

Beg. śirah śaś mām (?) śikhānisyandicandrikah /
anakāraharam divyam sindhubhūṣam bhaje mahah //

adodho kramaśotkīrṇacandratattuṅgasaṅgamāt /
pratyaham vākyanavakāt sphuṭacandrāptir ucyate //

Ms. 1055-A (inc., 60 gr.)

Citrabhānu, (*c.* 1475-1550), Namputiri of the Gautama-gotra, from Śivapura (Covvaram), near Tirchur.

—*Karaṇāmṛta* (A.D. 1530)

Ref. See above, p. 57, § 28 ; Raja, 153-55 ; Ul. 273-75 ; Ul. Sup. I. 305-6.

Citrabhānu-śiṣya, (*c.* 1525-75)

—C II on *Jātakapaddhati*

—*Bhāvacintāvalī*

Ref. See above, p. 57, § 29 ; Ul. II. 275. **Note :** The maṅgala-ślokas of *Bhāvacintāvalī* and the anon. *Pañcabodha* II, C IV, *Grahaṇāṣṭaka* III, *Praśnabhaṣa* I and *Muhūrtapadavī* II, C V exhibit close similarity as to suspect their common authorship.

Cintājñāna or *Kṛṣṇīya* (astrol.), by Kṛṣṇa, in 32 chs., 1500 gr.

Mss. See *Ker.*, I. 165, and Mad., under *Kṛṣṇīya.* Edn. by P.S. Purushottaman Namputiri, with his own Mal. C, Quilon, 1106 M.E.

Do.—C, *Caturasundarī*, by Viṣṇu, 1500 gr.

Mss. See *Ker.*, I. p. 165 and Mad. under *Kṛṣṇīya.*

Cozhiprasna (pra.), Mal. prose, Anon., 305 gr. Ms L. 225.

Chāyāgaṇanāṣṭaka (?) (kar.), Anon.

Beg. abhyūhite candra ... (1); indūcconita ... (2); pātonāc ca (3). **Ms.** With K.V. Sarma.

Chāyāgaṇita I (kar.), Skt.-Mal., Anon., 45 gr. Ms. 931-D.

Chāyāgaṇita (?) II (kar.), Anon., Mal. verse.

Beg. sūryacchāya gaṇikkeṇṭil tatkālārkane veccutan /

ayanāṁśaṅṅal kūṭṭiṭṭu caravum krāntibāṇavum //

Ms. 5126-A (450 gr.)

Chāyāgrahaṇagaṇita (?) II. (kar.), Anon., prose and verse.

Beg. pāṭum piṛappum eṇṇeṇṭil collunnuṇṭu curukki ñān /

iṣṭagrahayor arkan eṛunnāl udayattinu //

Ms. 13430-A (300 gr.)

Chāyāṣṭaka (kar.), by Acyuta Piṣāraṭi. Ms. P. 4116-A, in a misc. folio.

Janmavāraphalādi (jā.), Skt.-Mal., Anon. Ms. 4184-A.

[*Jatakakarmapaddhati*, *Jātakapaddhati* or *Śrīpatipaddhati* (jā.) by Śrīpati].

—C I, *Jatakalaṅkāra*, by Sūryadeva Yajvan.

Mss. See *Ker.*, I. 229 ; Baroda, Mad.

Do.—C II, by Parameśvara of Vaṭaśreṇi.

Mss. 665, C. 2337-C ; Ad. Mad. ; Āzhvāñceri Mana List, 167-D.

Do.—C III (Mal.), Anon.

Beg. aviṭe naṭe ācāryan guprupraṇāmatte munpeṭuttu cikīrṣitatte pratijña ceyyunnū—natvā tām gurudevatām ...

Ms. C. 543-B. Ref. Ul. III. 237.

Jatakakramam (jā.), (Mal.), by Śaṅkaran Nampūtiri of Mahiṣamaṅ-galam, 1500 gr.

Mss. 5129-H, C. 2173-A, C. 2216. Ref. Ul. II. 473.

Jatakagaṇita (jā.), Skt.-Mal., Anon. Ms. 13194-H.

Jatakacandrika I (jā.), Skt.-Mal., Anon. Ms. 3634.

Jatakacandrika II : Name of C by Parameśvara III, pupil of Śaṅkara, on *Hora*.

Jatakacintā (jā.), Mal. prose, Anon. Ms. 13029-C.

Jatakanidhāna (jā), Mal. prose, Anon. Ms. L. 327-C.

Jatakapaddhati (jā.), by Parameśvara of Vaṭaśreṇi, in 44 verses.

Mss. See *Ker.*, I. p. 229. Edn. *Śrī Vañchi Setu Lakshmi Series*, No. 2, Trivandrum, 1926. Ref. Ul. II. 103 ; Va. III. 379-81, where it is taken to be by a different Parameśvara.

Do.—C I *Balabodhinī* or *Balaprabodhinī*, Anon., by a native of Vaikkom.

Beg. vyāghragrameśa ... (1) ; vidyādāyyapy avidyādam... (2) ;

Vaṭaśreṇīl loke 'smin prasiddhasya divijanmanaḥ |
kṛter vilikhyate vyākhyā svalpā *Jatakapaddhateh* ||

Mss. 5097-B, C. 914-A, B, C. 1512-B, C.2478-E ; Āzhvāñceri List, 167-E. Ref. Ul. III. 89-90 ; Ul. Sup. I. 464 ; Va. III. 382-83.

Jatakapaddhati (contd.)

Do.—C II (Mal.), by a pupil of Citrabhānu, 400 gr.

> **Beg.** natvā gaṇeśvaram vāṇim Citrabhānvādikān gurūn /
> bhaktyā Jātakapaddhatyā kriyāmārgam vilikhyate //
> aviṭe nate — candrārkajanyarkṣikayoś ca patyoḥ...

> **Ms.** C. 543-B.

Do.—C III (Mal.), *Bhāṣājātakapaddhati*, an exposition in verse, with extra matter, by Kṛṣṇadāsa (Koccu-Kṛṣṇan Āśān).

> **Mss.** CM. 543-B, CM. 2123-B. **Edn.** *Śri Vanchi Lakshmi Series*,
> No. 3, Trivandrum, 1926. **Ref.** Ul. III. 520, 523 ; Va.
> III. 384-85.

Do.—C IV (Mal.), by Śiikaṇṭha of Veḷḷārakkāḍu (?)

> **Col.** Śvetagrāmāṭavī-samśrita ... Śrīkaṇṭhaḥ kaścid etat sapadi
> likhitavān pustakam devadāsaḥ //

> **Edn** In an adapted form, under the title *Balapiṇḍavum āyur-
> dāyavum*, as app. to *Jātakadeśa*, ed. Kanippayyoor
> Sankaran Namputirippād, Kunnamkulam, 2nd edn., M.E.
> 1102.

Do.—C V (Mal.), Anon., 400 gr.

> **Beg.** harihara-sarasiruhāsana ... (1) ; gaṇḍāntanirgalad ... (2) ;
> pañcāsadakṣara ... (3) ; Śrī-*Vaṭaśreṇi*-bhūdevaiḥ ... (4) ;
> aviṭe naṭe jananakālatte chāya koṇṭu tān ambuyantram
> koṇṭutān ...

> **Mss.** 421-B, 1134-B, CM. 563- B ; Āzhvāñceri List, 167-B,
> Trippunithura Skt. Col. 804-B. **Ref.** Ul. III. 245-46.

Do.—C VI (Mal.), Anon., 240 gr.

> **Beg.** perul— janmalagnasphuṭatte vaccu ayanacalanam kūṭṭiyatu...
> **Ms.** 5880-C.

Do.—C VII (Mal.), Anon., 180 gr.

> **Beg.** 'kuryāt sāyanalagnataś ca' ādyapādyam, 'sandhigrahāntara-
> kālādi'padyam iti lagnasphuṭannaḷe sūkṣmamāyi varutti ...
> **Ms.** L. 984.

Do.—C VIII (Mal.), Anon.

> **Beg.** jananakālatte udayalagnam uṇṭākki ayanacalanam kūṭṭi
> caravum prāṇakalāntaravum koṇṭu...
> **Mss.** P. 878 ; Trippunithura Skt. Col. 804-A.

Do.—See also *Jatakakarmapaddhati*, *Laghujātakapaddhati*.

Jatakaphalam (jā.), Mal. verse, Anon., 500 gr.

Beg. gurukkanmāre vandiccittavarāl uktamāyatil /
curukki *Jatakaphalam* kuraññonniha likhyate //
mūrttiyum kīrttiyum sthānam...

Mss. See *Ker. Mal.*, p. 60. **Ref.** Ul. III. 239 ; Ul. Sup.
I. 537.

Jatakabhavaphalam (?) (jā.), Anon., (Kar. ?).

Beg. astu trailokyadīpāya bhaktābhimatadāyine /
samastavidyānirmāṇakavaye ravaye namaḥ //
vṛttākṣo janavallabho 'ticapalo ...

Ms. C. 267-A (1700 gr).

Jatakamatrka (jā.), Skt.-Mal., Anon,

Mss. 6007-D, C. 155-A, T. 147-A.

Jatakarahasya or *Keralanirṇaya* by Vararuci : See *Varaurucikerala.*

Jatakalekhanakrama I (jā.), Mal., Anon., 400 gr.

Beg. ślokam mun tottanāḷ pinne rāśiyum nāmadheyavum /
ādityādisphutam sarvam bhāṣayil kalināḷ punaḥ //

Mss. 8268-E, PM. 4329-E, T. 147-B, T. 154-B-4.

Jatakalekhanakrama II (jā.), Mal. verse and prose, Anon.

Beg. jātakam ezhutuvānuḷḷa kramaññal collunnū. naṭe tanne
gaṇapatikku kuriccu ...

Ref. Ul. III. 238.

Jatakalekhanakrama (?) III (jā.), Mal. verse, Anon.

Beg. iṣṭadevata vandiccāl iṣṭamām keṭṭanāḷiṭū /
lagnam drekkāṇavum perum grahatalkālavākyavum //

Ms. PM. 4117.

Jatakalekhanakrama IV (jā.), Mal. verse, Anon.

Beg. talkālārkkane vaccittu vēre muppatu tiyati /
vaccāl atil kaḷaññiṭṭu arkante bhāgaliptakaḷ //

Ms. PM. 4158-H.

Jatakasara I (jā.), (Skt.) by Śaṅkara of Mahiṣamaṅgalam, 485 gr.

> Beg.   vande 'ham iśam girijāsametam ... (1) ; ajākhyam ādyam ca ... (2) ; siṁham ca kanyām ca ... (3).

> Mss.   PM. 4111-B, T. 268-C.

Iatakasara II (jā.), Mal., by Śaṅkara of Mahiṣamaṅgalam, in 7 chs.

> Beg.   vande giiiśam girijāsametam ... (1) ; santatiyum kaḷatravum nirūpikkeṇṭumpoḷ ...

> Mss.   P. 882 ; PM. 4026-C ; T. 144-D (a).   Ref.   Ul. III. 241-42.

Jatakasara III (jā.), Mal. prose, by (a diff.) Śaṅkara, in 4 chs.

> Beg.   jātakam ezhutuvām naṭe lagnam niścayiccu ...

> Ms.   C. 1205-A (950 gr.)

Iatakasarasangraha (jā.), by Āzhvāñceri Tamprākkaḷ, in 6 khaṇḍas. 184 verses.

> Mss.   C. 2431-D ; Ad. ; Mad.

Do.—C (Mal.), by the author himself.

> Ms.   L. 1217-A.

Jatakadeśamarga I (jā.), by Putumana Somayāji, 335 gr.

> Beg.   madiyahṛdayākāśe... (1) ;   gaṇeśādin namaskṛtya... (2) ; kujenduketu... (3)

> End :   guror lagneśadāreśa... ; suteśaśaśiśukreṣu... ;
> *Navālayavanākhyena* dhīmatā *Somayājinā* |
> kṛtam prakaraṇam hy etad daivajñajanatuṣṭaye ||

> Ms.   CM. 2197-F.

Do.—C I (Mal.), Anon., 1100 gr.

> Beg.   eṉṉāl gaṇapati tuṭaṅṅiyuḷḷavarre namaskaricciṭṭu...

> Mss.   CM. 2197-G, L. 1092- C.

Do.   C. II (Mal.), Anon.   Ms. L. 1097-A.

Jatakadeśamarga II (jā.), by Putumana Somayāji (?) in 16 chs.

> Beg.   madiyahṛdayākāśe... (1) ; mūrdhāsya galaskandha.. (2) ; matsyau ghaṭī... (3) ; kriyatāvuru... (4) ; aruṇasita... (5)

> End.   tatra śubhāśubhayogā...

Jatakadeśamārga II (contd.)

Edn. By Kanippayyoor Sankaran Namputirippad, 5th edn., Kunnamkulam, M. E. 1125 ; By V. N. Sankunni Nair, A.R P. Press, Kunnamkulam, M.E. 1105.

Jatakadeśaratna (jā.), by Nārāyaṇan Iḷayatu of Maccāṭ, being an adaptation of the *Jatakadeśamārga* of Putumana Somayāji.

Men. By the author's grandpupil, Puruṣottama III, in his *Praśnāyana*, III. 19 ; VIII. 81. **Ref.** Ul. III. 529 ; Ul. Sup. I. 225,

Jatakanītimārga (jā.), by Azhvāñceri Tamprākkaḷ, in 14 khaṇḍas, 166 verses. **Ms.** C. 2331-A.

Do.—C (Mal.), by author himself, 1300 gr. **Ms.** C. 2431-B.

Jatakabharaṇam (jā.), by Acyuta Piṣāraṭi.

Beg. mūrtitva parikalpitaḥ... (1) ; ṣaḍānām... (2) ; guṟūṇām caraṇāmbhoja... (3) ; Varāhahorām ālokya... (4)

Ms. C. 2139-A. **Ref.** Ul. II. 324.

Jatakalaṅkāra : Name of Sūryadeva Yajvan's C on *Jatakakarma-paddhatl.*

Jatakodaya or *Uḍujātakodaya* (jā.), Anon., by a Brahman of Veṇāḍ in S. Kerala, 103 verses.

Beg. gurūn upāsya śāstrāṇi samāloḍyābhiyujya ca / niścityāvyabhicāritvam kriyate *Jatakodayaḥ* ||

End. *Dvijena* kenāpy *Uḍu-Jātakodayam*
, kṛtam dvi-(?) *Veṇāṭikadeśajanmanā* /
trayādhikślokaśatena nirmitam
hitāya taj jātakasāravedinām ||

sarvoktam etc.

Mss. 1004-D C. 1912-E, L. 1248-D, P. 833, T. 283.

Jīvanayanam (?) (astron.), Anon , misc. composition.

Beg. nihatya cāpavargeṇa cāpam tattatphalāni ca /

Ms. 8358-C (inc., 100 gr.)

Jīvadyanayanam (?) (astron.), Mal. verse, Anon.

Beg. anūnanūtnānanunununnanityaiḥ...

Ms. 14152-C (inc., 75 gr.)

Jyāh I (astron.), mnemonic sine tables etc.

Beg. gaṇānām adhipas caṇḍo gajavaktravilocanaḥ /
prīto bhavatu me nityam varadātā vināyakaḥ //
janena satyena...

Ms. C. 595-C (140 gr.)

Do II. **Mss.** See *Ker.*, I. p. 238 ; *Ker. Mal.*, p. 62.

Jyākhaṇḍādyānayana (?) (astron.). Mal., Anon.

Ms. T. 323 (inc., 1910 gr.)

Jyāgaṇita (?) (astron.), Anon.

Beg. lakuṭena samabhyastā rāśicakrakalā haret /
śalmaleti stutir labdhā tadartham tridamaurvikā //

Ms. L. 765-G.

Do.— (Mal.), Anon. Ms. L. 765-G (160 gr.)

Jyeṣṭhadeva, (1500-1610). of the Paraṅṅoṭṭu family in the Ālattūr
village ; pupil of Dāmodara and teacher of Acyuta Piṣārati.

—*Gaṇitayukti*

—*Dṛkkaraṇam* (Mal.)

—*Yuktibhāṣā* (Mal.)

Ref. See above, pp. 59-60, § 32 ; K. V. Sarma, 'Jyeṣṭhadeva and
his identification as the author of *Yuktibhāṣā*', *Adyar Lib.
Bulletin*, 22 (1958) 35-40; Raja, 156-58.

Jyeṣṭhadeva-śiṣya, (c. 1550-1625).

—C in verse on *Tantrasaṅgraha.*

Ref. See above, p. 60, § 33; Raja, 158.

Jyotiśśāstrasaṅgraha (astron.-astrol.), by Azhvāñceri Tamprākkaḷ,
in two parts : I. *Siddhāntaskandha* or *Gaṇitaskandha,* and II. *Horā-
skandha* (*Muhūrta, Jātaka* and *Praśna*).

Mss. CM. 6-A, L. 1179, L. 1221-A, T. 1156 : Vaṭavarkkoṭṭu
Mana, Venkitangu, List II. 12-A. Note. For an exposition
of the principles involved, see *Saṅgrahasādhanakriyā.*

Do.—C (Mal.), by the author himself.

Mss. See *Ker. Mal.,* p. 42 (under *Gaṇitasaṅgraha*) ; p. 62 ;
Vaṭavarkoṭṭu Mana, Venkitangu, List II. 12-B.

Jyotiṣadīpamula (astron.-astrol.), Mal. verse, Anon. 5 chs., 750 gr.

Beg. gaṇapatiguruvāṇīm arkacandrārasaumyān
suragurusitamandam rāhuketum vaṇaṅṅi /
gaṇitam api muhūrttam jātakam praśnabhāgam
laghutaram iha collām mardadhīdhāraṇāya //

Mss. See *Ker. Mal.*, pp. 62-63; C. 1864-C. **Ref.** Ul. II. 228-29.

Jyotiṣapaddhati (astron.-astrol.), Mal. verses, Śītaṅkan tuḷḷal, Anon.

Ms. 10967-C.

Jyotiṣaprakāśa : Name of C by Rājarāja Varmā Koyittampurān on the *Golādhyāya* of Bhāskara II.

Jyotiṣapradīpa (astron.), Mal., by Rāma Varma Koyittampurān of Gramam.

Ref. Ul. IV. 545.

Jyotiṣabhaṣāccārttu (astrol.), Mal., Anon. **Ms.** L. 1250.

Jyotiṣabhaṣāvalī or *Māccāṭṭu Bhāṣā* (astron.-astrol.), Mal., by Nārā-yaṇan Ilayatu of Maccāṭṭu house. **Ref.** Ul. III. 529; Va. IV. 221.

Jyotiṣavākyāni (mnemonic sine and other tables), Anon. **Mss.** See *Ker.*, I. p. 239.

[*Jyotiṣasaṅgraha* I (astrol.), Anon.]

—C (Mal.), Anon.

Beg. pañca prācīr ālikhed bāṇasaṅkhyāḥ
tiryagrekhāvarjitāntaś catuṣkāḥ /
prāgādīśā dvādaśavyomavāsāḥ
jyotiścakrasvāminas tūbarādyāḥ //

Ms. Mad. D. 13765.

Jyotiṣasaṅgraha II (astrol.), Mal., by a pupil of Maṅgalaśreṇi-vipra.

Beg. *Maṅgalaśreṇīviprendugurupādāmbujadvayam* |
vandiccittu camaykkunnen Bhāṣā-*Jyotiṣasaṅgraham* ||

Ms. T. 142 (inc., 120 gr.)

Tamprakkal Bhāṣa **:** Nama of the Mal. C-s of Azhvāñceri Tam-
prākkaḷ on his several works and on the *Muhūrtapadavī*, esp. the
last.

Tantrasaṅgraha I (astron.), by Nīlakaṇṭha Somayāji, in 8 chs.,
450 gr., A.D. 1500.

Mss. See *Ker.*, II. pp. 16-17; Ad. ; Mad. Edn. *TSS* 188. Ref.
Ul. II. 118.

Do.—C I, *Kriyākalāpa,* by Śaṅkara Vāriyar of Tṛkkuṭaveli.

Beg: tatra tāvat kalyāder ārabhya   yātān abdān dvādaśabhir
nihatya......

Ms. L. 1329-A (2000 gr.) Ref. See above, pp. 58-59, § 31.

Do.—C II, *Laghuvivṛti,* by Śaṅkara Vāriyar of Tṛkkuṭaveli.

Mss. See *Ker.*, II. pp. 16-17; Mad Edn. *TSS* 188. **Ref.** Ul.
II. 120-21; Va. II. 498-99.

Do.—C III, in verse, by an anon. pupil of Jyeṣṭhadeva, for chs.
I-IV only ; 2600 gr.

Mss. 586-E, C. 1375, L. 1302; Mad. R. 2505. Ref. Ul. II. 120;
Va. II. 498.

Do.—C IV, *Laghuvyākhyā,* anon., possibly by a Tamil astronomer.

Mss. Panjab Univ. Lib., (Lahore), *Catal.*, II, p. 220, mss. nos.
3494, 3495, both in grantha script.

Do—C V (Mal.), Anon., 4300 gr.

Beg. aviṭe ācāryan ārambhippānāyikkoṇṭu icchikkappeṭṭirikkunna
Tantrasaṅgrahattinte...

Mss. See *Ker.*, II. p. 17; *Ker Mal.*, p. 64.

Tantrasaṅgraha II (astron.), Mal. prose, Anon., Mss. 8380,
T. 211-C.

Tantrasaṅgrahāt Sphuṭanirṇayabhagaṇaḥ (?) (astron.), Anon.

Beg. *Tantrasaṅgraha*-samprokta-kalyādi-dhruvaparyayaiḥ /
Sphuṭanirṇaya-samproktā bhagaṇānītir ucyate //

Ms. With K.V. Sarma.

Tantrasāra (astron.), by Nārāyaṇa of Perumanam village.

Ms. With Rāma Varmā Maru Tampurān of Chalakkudi.

Ref. Raja, 153.

Do.—C (Mal.) Ms. With the text above.

Tāmaranallūr

—*Muhūrtam-Bhāṣā* or *Tāmaranallūr Bhāṣā.*

Ref. See above, p. 49, § 18.

Tāmaranallūr-Bhāṣā :   See under *Muhūrtam Bhāṣā.*

Tāmbūlaprasnādiphalam (pra), Mal verse, Anon.   Ms. L. 1187-C.

Tāmbūlādiprasna (pra.), Mal. prose, Anon.   Ms.   3383-H.

Tithinakṣatrādiphalam (astrol.), Mal. prose, Anon,   Ms. L. 247.

Tithinirṇaya (astron.), Mal. verse, Anon.   Ms. L. 336-B

Tuppan Nampūtiri, (*c.*   1725-1800), of Iṭavaṭṭikkāṭṭu family   in
    Central Kerala.

—*Muhūrtapadavī* VI

Ref. See above, pp. 59-60, § 59 ; Ul. III. 470-76.

Tṛppāṇikkara Putuvāl,   (17th cent.), astrological authority, pupil of
    Acyuta Piṣāraṭi.   **Ref.** See above, p. 5.

Trirāśijyavākyāni (?), misc. astron. mnemonics.   Ms. L.   1328
    (40 gr.)

Dakṣiṇārmūrti Mūssatu of Maṅgalasśeri, (18th-19th cent.), astrological
    authority, **Ref.** See above, p. 5.

Daśapporuttam (astrol.), Skt.-Mal., Anon., 10 gr. Ms. C. 2421-E.

Daśadhyāyī : Name of C by Govinda Bhaṭṭatiri on *Horā.*

Daśaphalavicāra (artrol.), Anon.   Ms. Pāliyam List, 634.

Daśāvatārappaṭṭika (astron.), Mal. prose, Anon., 150   gr.
    Ms. 13475-D.

Daśaviśeṣaphala (astrol.), Ms. Pāliyam List, 614.

Dāmodara I, (15th cent.), of Vaṭaśreṇi, son of Parameśvara and
    teacher of Nīlakaṇṭha Somayāji, **Ref.** See above, pp. 54-55, § 24

Dāmodara II : Dạmodaran Namputiri, (*c.* 1675-1775), of Mangala-śśeri in Perumanam in N. Malabar.

—*Praśnarīti* 1

—C on *Lilāvati*

Ref. See above, pp. 65-66, § 42 ; Va. III. 378-79.

Damodara III of the Bhāradvāja gotra, brother of Keśava, hailing from Cellūr.

—*Muhūrtabharaṇa*

Dūtalakṣaṇa-bhāṣa : See under *Āyudhalakṣaṇa.*

Dṛkkaraṇam (kar.), by Jyeṣṭhadeva (?), in 10 chs., 475 gr., A.D. 1608.

Ms. C. 7-C. **Ref.** For the tradition that the au. is the same as the au. of *Yuktibhāṣa* (*i.e.,* Jyeṣṭhadeva), see M. Whish, *Trans. Royal As. Soc.* 3 (1835) 523. On the work, see Ul. II. 478 ; Ul. Sup. I. 226.

Dṛkparahitam (kar.), Anon.

Beg. nitvā madhym viliptāvadhikam urudharādyāptahīne dhruvādhye kṣiptvāsmin deśabhedam ravibhujacarayor ...

Ms. Mad. D. 13447 (cata. as *Pañcāṅgagaṇitaviṣaya*).

Dṛggaṇita (kar.), by Parameśvara of Vaṭaśreṇi.

Mss. 411-B, 13300-E, L. 1248-E, L. 1243-I ; with K.V. Sarma.

Edn. K.V. Sarma, V.V.R. Inst., Hoshiarpur, 1963. **Ref.** Ul. II. 102 ; Va. I.379-80.

Dṛggaṇitakrama (?) (kar.), Anon., Mal. verse.

Beg. kulina-rūkṣajña-vidhāna-mātrayā ...

Ms. PM. 4116 (320 gr.)

Dṛggaṇitajyavakyani (kar.). Ms. Baroda, p. 1198 (ms. no- 9942-d).

Dṛggaṇitaprakara (?) (kar.), (Mal.), Anon.

Beg. ini Dṛggaṇitattinte prakāram paṛayinnitu—
arkano bhedamillallo dṛkkil parahitattilum /
kujannu madhyame dṛkkil bhedamilliha tuṅganum //

Ms. 189-B.

Dṛg-veṇvarohakriya (kar.), Anon. Epoch : A.D. 1695. **Ms.** 5867
(ff. 163-65). **Edn.** K.V. Sarma, App. II to his edn. of *Veṇvāroha*,
Trippunithura, 1956.

Dṛṣṭāntapraśna (pra.), Old Mal., Anon., 298 gr.

Beg. ādiyām paramakalyāṇi uḷḷattill ninnum kuṭikoḷḷunna
uḷḷamuṭyān rakṣa rakṣa. Śivālayam—
(na)lam itu karumam naṇṭa ānattol viṣṇuviṉāle
itam paṭavuratten colluvaṭināl Agastyan keḷkka
nītiyāl pūtalattil vāḷka, oḷḷatellām arivināi.

Ms. PM. 4125-A.

Dṛṣṭāntamāla or *Śakunamuṣṭi* I (pra.), Old. Mal., Anon., in the
form of questions and answers.

Beg. ī rājāvinekkaṇṭāl śubhamo aśuhhamo ennu collu.

Mss. PM : 4122, 4123, 4125-B, 4126, 4309.

Dṛṣṭāntamālā or *Śakunamuṣṭi* II (pra.), Old. Mal., Anon.

Beg. innirupicca kāryam śubhamo aśubhamo ennu. innurupicca
kāryam ninacca vaṇṇam varum. iviṭe devālayam uṇṭākkiyāl
guṇam varum. **Ms.** PM. 4124.

Devakerala (astrol.), called also *Keralajyotiṣa, Keralarahasya,
Candrakalā-nāḍī* and *Candranāḍī*, by Acyuta I, a 'Kerala-
brāhmaṇa'.

Mss. Mad. D. 13775-79, R : 853-a, 3322, 4056 ; Ad. **Edn.** Gov.
Or. Mss. Lib., Madras, 3 vols., 1952-56. **Ref.** Ul. 1. 164.

Daivanukūlyādi (astrol.), Anon.

Beg. atha daivānukūlyādikam nirūpyate.
devair vā dharmadevaiḥ phaṇipatigurubhir brahmaṇaiḥ
Ms. C. 584-C.   pretabhūtaiḥ /

Drekkaṇadivicāra (astrol.), (Skt.-Mal.), Anon. **Ms.** 13494-H.

Dviśatī or *Prakāśalatikā* (astrol.), Anon., by a devotee of Śiva
installed at Talipparamba (Cellūr) in N. Kerala and protege of the
Nampūtiri family of Vāraṇakkoḍ.

Beg. yasyānuvelam udaye ... (1) ; lakṣmīpureśam ... (2) ; dvai-
māturam ... *Prakāśalatikām Dviśatīm* likhāmi //3//

Ref. Va. III. 611-15.

Nakṣatram nokkal ('star gazing'), (Mal.), Anon., a single verse to derive the time for sunrise from the position of a star.

Verse : uccappeṭṭoru nakṣatram tcṭṭeṭṭolm punar añhineyeṇṇi /
ettiñkēnnatu ñāṭṭilayoḷam atrayum atrayum arkan udippān //
sūryan udippān ini etra samayam uṇṭennarivān.

Ref. Q in 'Samayam nirṇayikkān' by M.R. Vargheese, *Mathru-
bhumi Weekly*, (Kozhikode), 7-11-1954, p. 45.

Nakṣatrappāna (astron.), Mal. verse, Anon., 20 gr.

Beg. oṇam mūnnu muzhakkol pol
uccaykku meṭaṭtil cellum onnara nāzhika.

Ref. 5038-C, 14228-D, PM. 4328-C, PM. 4368-D.

Naracesṭā (pra.) Anon , (Ker. ?)

Beg. ādiyādin grahān natvā śubhāśubhasusūcakān /
yathāśāstram yathāpraśnam *Naracesṭām* pracakṣmahe //

Ms. C. 2137-C.

Navagrahavākyāni (?), (mnemonic tables in verse form), Anon., 30 gr.

Beg. devo vanālokanapūjanottamaḥ.

Ms. 11044-V.

Navagrahasamaya : See *Aṅkaṇaśāstra*.

Nasṭajātakakriyā (astrol.), Mal. prose, Anon.   Mss. 13487-D,
L. 1217-D.

Nasṭajātakapraśna (pra.), Mal. prose, Anon.   Ms. 794-B.

Nasṭajātakādi (astrol.), Skt.-Mal., Anon. Mss. 10999-A ; Vayas kara
Illam, Kottayam, 92-B.

Nārāyaṇa I, (c. 1500-75), pupil of another Nārāyaṇa and admirer of
Nilakaṇṭha Somayāji.

—*Uparāgakriyākrama*

—C *Karmadīpika* or *Kriyakramakari* on *Lilāvati*, Version I

—C   Do.   Do.   Do., Version II

—C (I), *Laghuvivṛti* on *Pañcabodha* IV.

Ref. See above, p. 57-58, § 30 ; Ul. II. 121 ; Ul. Sup. I. 227-28.

Nārāyaṇa II, son of Keśava, resident of Kāṇvavastu (Tṛkkaṇṇapuram or Kaṇṇanparuampu) in Malabar.

—*Muhūrtadīpaka*

Ref. See above, p. 62, § 35 ; Ul. II. 107 ; Va. II. 612-13.

Nārāyaṇa III

—*Laghudarśinī*

Ref. See above, p. 65, § 41.

Nārāyaṇa IV : Nārāyaṇan Nampūtiri (18th cent.) of Iṭavaṭṭikkāṭṭu family in Central Kerala.

—*Muhūrtapadavī* VII

Ref. See above, p. 73, § 60 ; Ul. III. 470-76.

Nārāyaṇa V, of Perumaṇam village.

—*Tantrasāra*

Ref. See above, 74, § 64 ; Raja, 153.

Nārāyaṇa VI : Nārāyaṇan Iḷayatu of Maccāṭ (1765-1843).

—*Jātakādeśaratna*

—*Jyotiṣabhaṣāvali* or *Maccāṭṭu Bhāṣā* (Mal.)

Ref. See above, p. 76, § 71 ; Ul. III. 527-29 ; Ul. Sup. I.648-49 ; Va. IV. 216-21.

Nārāyaṇa VII, (c. 1325-1400), son of Parameśvara and teacher of Parameśvara (promulgator of *Dṛggaṇita*). Ref. See above, p. 53, § 23.

Nārāyaṇa VIII, (19th cent.), teacher of Puruṣottama (au. of *Praśna-yana*). Ref. See above, p. 79, § 79.

Nāvāyikkuḷattu Āzhāti, (17th cent.), astrological authority.

Ref. See above, p. 5.

Nalum pakkavum aṟivān (kar.), (Mal.), computation of day, tithi, etc. Anon.

Beg. akārādi patimūnnakṣaram śūnyam. oṭukkatte akṣaram kāryam ākunnatu.

Ms. C. 9-F.

Nazhikamaṇiyute yukti (Mal.), Anon., a detailed exposition of the pendulam clock. Ms. With K.V. Sarma.

Nityaprakāśa Yati or °Bhaṭṭāraka, pupil of Ānandaprakāśa.

—C *Prakāśika* or *Viṣamākṣaravivṛti* on *Horā.*

—C *Prakaśika* (Mal.), on *Horā*

Ref. See above, p. 50, § 19.

Nimittapraśna (pra.), Mal. prose, Anon. Ms. L. 28.

Nirgaṇita (kar.), Anon. **Men.** In the *Karaṇapaddhatī* of Putumana Somayāji, IV. 3.

Nihatya capavargeṇetyadi-ślokāḥ : See *Mahājyānayanaprakārah.*

Nīlakaṇṭha I : Nīlakaṇṭha Somayāji, (1444-1545), of the Garga-gotra, of Kerala-sad-grāma (Mal. Keḷallūr) ; pupil of Dāmodara and grand-pupil of Parameśvara I.

—*Gaṇitadarpaṇa* (?)

—*Golasāra*

—*Grahaṇanirṇaya*

—*Grahaṇādigrantha*

—*Grahaparikṣākrama*

—*Candracchāyāgaṇita*

—*Tantrasaṅgraha*

—*Siddhāntadarpaṇa*

—*Sundararājapraśnottara*

—C *Bhāṣya* on *Āryabhaṭīya*

—C on his own *Candracchāyāgaṇita*

—C on his own *Siddhāntadarpaṇa*

Ref. See above, pp. 19, 22-23 ; 55-57, § 26 ; K.V. Sarma, 'Gārgya Kerala Nīlakaṇṭha Somayājin', *Jl. of Or. Res.*, 26 (1956-57) 24-39 ; Raja, 143-52 ; Sen, pp. 155-57 ; Ul. II. 117-20 ; Ul. Sup. I. 235-37 ; Va. I. 383-87.

Nīlakaṇṭha II, (16th-17th cent.)

—*Kaṇakkusāram* (Mal.)

—C (Mal.) on *Kaṇakkusāram.*

Ref. See above, p. 65, § 40.

Nilakaṇṭha III : Nilakaṇṭha Śarmā of Punnaśśeri, (1858-1935).

—*Jyotiśśastra-subodhinī* (Mal.)

—C (Mal.) on *Camatkāracintāmaṇi*

—C (Mal.) *Pañcabodhakriyā-Bhāṣā* on *Pañcabodha*

—C (Mal.) *Uparatnaśikha* on *Praśnamārga*

Ref. See above, p. 81, § 81 ; Ul. V. 964-70 ; Ul. Sup. II. 500 ;
Va. V. 192-204.

Nyāyaratna, version I (astronomical rationale), by Putumana
Somayāji, in 8 chs., 120 gr.

Beg. madīyahṛdayākāśe cidānandamayo guruḥ /
udetu satatam samyag ajñānatimirāruṇaḥ //
namaskṛtya gurūn bhaktyā...(2) ; anuktāviha sarvatra...(3) ;
tulājādigatam svarṇam ... (4).

End : apakrāntyayanāntastha ... ; koṭikrānteḥ ... ; nyāyapradar-
śanāyaivam ...

Mss. 414-C, 597-B, 11013-B ; C. 964-A ; T. 464-A ; Mad. R. 5344.

Nyāyaratna, version II (astronomical rationale), by Putumana
Somayāji, in 8 chs., 120 gr.

Beg. madīyahṛdayākāśe ... (1) ; namaskṛtya gurūn bhaktyā...(2) :
iha grahāḥ sphuṭikāryāḥ ... (3) ; kujāder antyakendrot-
tha ... (4) ; antyakendrabhujābhāve ... (5).

End : yugmaujapadajam... ; svadoḥkrāntyukta...; alpakrāntyāya-
nāntastha ... : nyāyapradarśanāyaivam ...

Ms. With K.V. Sarma.

Pakiṭapraśna (pra.), Mal. prose, Anon., 550 gr. Mss. 4133, 10964.

Pakṣiśāstram or *Pañcapakṣiśāstram* (astrol.), (Skt.-Mal.,) Anon.,
based on Agastya's *Pañcapakṣiśāstra* (For mss. of which see
Tanjore D. 11489-92), 100 gr.

Beg. abhivandya gaṇeśānam ... (1)

natvā vighneśvaram vāṇīm Pañcapakṣinidarśanam /

pur-Agastyena devebhyaḥ proktam saṅkṣipyate mayā //

Mss. C. 350-A, P. 589. **Ref.** Ul. III. 243 ; Ul. Sup. I. 539 ;
Va. II. 503.

Pañcapakṣilakṣaṇam (astrol.), Old Mal., verse, Anon.

Beg. covvā ñāyiru vallira ciranta tiṅkal budhan ānta /

Ms. PM. 4154.

Pañcapakṣiśāstram or *Pakṣiśāstram* : See under *Pakṣiśāstram*.

Pañcabodha I or *Prakīrṇasaṅgraha* (kar.), in 10 *khaṇḍas*.

Beg. yātāś ca māsā divasāś ca nāḍyaḥ svābhiṣṭakālāvadhikāḥ
kramena /
(Some mss. prefix a benedictory verse : yair aṁśakaiḥ sarva.
guhāśayasya ... The col. in several mss. read : *iti Prakīrṇa-
saṅgrahaḥ*)

Mss. 597, 831-B, 5376-B, 5864-B, 8985, 12455, C. 77, C. 364,
C. 588, L. 1360-A. **Edn.** Kanippayyoor Sankaran Nam-
putirippad, with modern com. in Mal., Panchangam Press,
Kunnamkulam, M.E. 1102 ; M.E. 1107.

Do.—C (Mal.), Anon.

Beg. yogyādikānam tu yathopadeśam ... **Mss.** 5376-B, 11061-L.

Pañcabodha II (kar.), Anon.

Beg. viṣuvaddyuganam nyasya māsavākyam dinani ca /
yuktvā śukrādivāram ca jñātvā khaṇḍam viśodhayet //
śeṣam guṇena saṁhṛtya ...

Ms. P. 890-A.

Do.—C (Mal.), *Pañcabodhakriyākrama* by Śaṅkaran Nampūtiri of
Mahiṣamaṅgalam.

Beg. tumpa tiṅkaloṭu ganga tanneyum ...

Ms. P. 890-A.

Pañcabodha III (kar.), by Putumana Somayāji in five *khaṇḍas* on
Vyatīpāta, Grahaṇa, Chāya, Śṛṅgonnati and *Mauḍhya* ; 85 gr.

Beg. devarṣiganais sevyam ... (1) ; madīyahṛdayākāśe ... (2) ;
golānte dviguṇāyanārkarahite prāyo vyatīpātabham ...

Mss. 414-A, T. 150-A, B ; Mad. Mal. D. 339, (pp. 1-7). **Rem.**
Authorship based on the characteristic intro. verse, *madīya-
hṛdayākāśe* etc. and the authority of Punnaśśeri
Nīlakaṇṭha Śarmā, *vide* his *Jyotiśśāstra-subodhinī.*

Pañcabodha III (contd.)

Do.—C (Mal.), Anon., 800 gr.

> **Beg** Pañcabodhakriyāślokavyākhyānam iha bhāṣayāy /
> gurūktarītyā collunnen bālānām arivān aham //

Mss. L. 893, T. 150-A, B.

Pañcabodha IV (kar.), Anon., in 5 *paricchedas* on *Vyatīpāta,
Mauḍhya, Chāyā, Śṛṅgonnati* and *Grahaṇa,* in 105 verses.

> **Beg.** sarveṣām jyotiṣām ādyam namaskṛtya divākaram /
> laghūkṛtya vidhāsyāmi vyatipātādibodhanam //
>
> yāvanmūlāntam ādityāj jalarkṣādeś ca tāvati /

> **Mss.** 475-G, 11103, C. 173-H, C. 595-B, L.843-A, P. 923-B ;
> PM. 4147-B ; Mad. R. 2754 (b) (under the title
> *Lāṭādipañcakam*).

Do.—C I, *Laghuvivṛti,* by Nārāyaṇa ; A.D. 1529 ; 600 gr.

> **Beg.** bhāsvantam andhatamasam ... (1) ; samastāny api karmāṇī
> ... (2) ; yatprasādād kavīndratvam ... (3) : śaktyā śaśvan
> nikhila ... (4) ; Nārāyaṇim jagadanugrahajāgarūkam /
> vidvattamam guṇanidhim sudṛdham praṇamya /
> lāṭādipañcaka-vibodhakarasya *Pañca-
> bodhasya cāru-vivṛtim* vilikhāmi *Laghvīm* // 5 //
> granthakāraś śiṣṭācāram anusaran ...

Mss. 411-A, T. 1184 ; Mad. R. 2754 (b) ; with K.V. Sarma.

Do.—C II (Mal.), *Pañcabodhārthadarpaṇam,* by Śaṅkaran Nampūṭiri
of Mahiṣamaṅgalam.

> **Beg.** śrīsūryādīn namaskṛtya gurum ca Parameśvaram /
> balāyāsmai vidhāsyāmi *Pañcabodhārthadarpaṇam* //

Mss. 10647-B. Ref. Ul. II. 472.

Do.—C III (Mal.), *Pañcabodhakriyākraman* or *Bālaśaṅkaram,* by
Śaṅkaran Nampūṭiri of Mahiṣamaṅgalam.

> **Beg.** dhātrī yatkarasamparkād ... (1) ; tumpa tiṅakḷoṭu gaṅga
> tanneyum ... (2) ; bālānām Pañcabodhārtham ... (3) ;
>
> bhāskarādīn vaṇaṅṅiṭṭu gurum ca Parameśvaram /
> cerutoṭṭezhutunnuṇṭu *Pañcabodhakriyākramam* //

> gaṇitattinnu Pañcabodhamākunna karaṇatte camappān
> tuṭaṅṅunna ācāryan ...

Pañcabodha IV (contd).

Mss. 3761-D, 10625, 10987-B, C. 173-L, C. 563-D, C. 2146-B, L. 1167-B. **Ref.** Ul. II. 472.

Do.—C IV, *Pañcabodhakriyākrama*, (Mal. verse), Anon.

Beg. gaṇeśānam gurum vāṇīm vaṇaṅṅikkoṇṭu bhāṣyāy /
ceṟuoṭṭezhutunnuṇṭu *Pañcabodhakriyākramam* //

annannu bhāskaran ninna nāḷ toṭṭāmūlam eṇṇuka /
pūrāṭād atra cennuḷḷa nāḷil annuḷḷa lāṭamām //

Mss. PM. 4366 (cata. *Vyatīpātagaṇitam*), PM. 4368-I. **Rem.** Apparently related to C III above.

Pañcabodha V or *Pañcabodhaśataka* (kar.), by Puruṣottama II

Beg. (*Grahaṇa* sn.) :

namaskṛtya guroḥ pādam mandajñānabhido varam /
sūryendvor uparāgoktavidhānam pravadāmy aham //

Col. *Puruṣottamakṛte Pañcabodhaśatake* Uparāgaparicchedaḥ sampūrṇam.

Ms. With K.V. Sarma. **Ref.** Ul. Sup. I. 224-25.

Pañcabodha VI (kar.), Anon.

Beg. arkendvor apamāntare 'pi padayos tadbimbayogārdhataḥ.

Ms. 8112.

Do.—C (Mal. prose), *Pañcabodham Bhāṣā*, Anon.

Beg. gurupādāmbujam natvā sarvadāśāsitārthadam /
*Pañcabodh*oktapaddhatyā *Bhāṣām* iha likhāmy aham //

aviṭe naṭe ācāryan vyatīpātalakṣaṇatteyum ...

Ms. 8112.

Pañcabodha VII (kar.), Anon., on the computation of *Chāyā, Grahaṇa, Vyatīpāta, Mauḍhya* and *Śṛṅgonnati.*

Beg iṣṭas sāyanabhāskara ... (1) ; kṛtāyaneṣṭārka ... (2) ; chā-yeṣṭaśaṅkukṛti ... (3).

Ms. With K.V. Sarma.

Do.—C (Mal.), Anon.

Beg. iṣṭadeśa-kālaṅṅaḷil sāyanārkasphuṭatte veccu ...

Ms. With K.V. Sarma.

Pañcabodha VIII (kar.) Anon., interspersed with Mal.

Beg. sindūrāruṇam iṇḍukāntivadanam keyūrahārādibhiḥ ... (1) ; sūryaḥ somo budhaḥ śukraḥ ... (2) : guṇakāraḥ kulam bhānoḥ ... (3).

Ms. 4124-B.

Pañcabodha IX (Kar.), Anon.

Beg. madīyahṛdayākāśe ... (1)
lāṭavaidbṛtam eṇṇuṇṇa prakāram atha collineṇ /
ayaṇāṃśam iraṭṭicciṭṭarkaṇil saṃskariccatu //

Ms. 1005-D (inc., 160 gr.)

Pañcabodha X, *Pañcabodhagaṇitam Bhāṣa* (kar.), (Mal.), by Kṛṣṇadāsa (Koccu-Kṛṣṇan Āśān). **Mss.** PM. 4111-A, PM. 4155-B. **Ref.** Ul. III. 524.

Pañcabodha XI (kar.), unidentified.

Do.—C (Mal.), by Vāsuṇṇi Mūssatu of Veḷḷānaśśeri. **Men.** Ul. IV. 700.

Pañcabodhakriyakrama by Śaṅkaran Nampūtiri : See C on *Pañcabodha* II.

Do.—Anon.: See C IV on *Pañcabodha* IV.

Pañcabodha-Gaṇitasāra (kar.), (Mal.), by Śaṅkaran Nampūtiri of Mahiṣamaṅgalam : See *Gaṇitasāra* II.

Pañcabodhaśataka by Puruṣottama : See *Pañcabodha* V.

Pañcbodhārtha-darpaṇam : See C III on *Pañcabodha* IV.

Pañcamahayoga (astrol.), (Skt.-Astrol.), Anon. **Ms.** L. 740-C.

Pañcāṅga (almanac), (Mal.), Anon. **Mss.** 5779 (for M.E. 1011-60), 5841 (for M.E 1061-80), 6010-A (for M.E. 1000-25).

Pañcāṅga (muhūrta), for 1000 years, attributed to Śaṅkaran Nampūtiri of Mahiṣamaṅgalam. **Ref.** Ul. II. 272.

Pañcāṅga : See also *Agaṇita*.

Pañcāṅgagaṇanaviṣaya (kar.), (Mal.), Anon. **Ms.** in Mad, D. 13454.

Pañcāṅgagaṇita (kar.), (Mal. verse), Anon. **Ms.** 8268-C (220 gr.).

Pañcangaphalam (astrol.), (Mal. verse), Anon. Mss. 6478-D,
12564-B, 13215-H, L. 144-G.

Pañcangaphalam : See also *Varādiphalanirṇaya*.

[*Pañcangavakya* (kar.),] -C (Mal.), Anon. Ms. Mad. D. 13454.

Paddhatiganitakriyā (kar.), (Mal. prose), Anon. 400 gr. Ms.
5074-B. Rem. Of which *Paddhatī* this is a *ganitakriyā* remains
to be ascertained.

Panakkāṭṭu or **Iṭakkāṭṭu Nampūtiri**, (*c.* 1615-95), son of Mahādeva and
Śrī, pupil of Dāmodaran Nampūtiri of Mangalaśśeri family.

    —*Ganitagrantha*

    —*Praśnamārga*

    —C *Durgamarthapradarśinī* on his own *Praśnamārga*

Ref. See above, pp. 66-67, § 45 ; Ul. III. 87-89 ; Va. III. 400-5.

Parameśvara I : Parameśvaran Nampūtiri, (*c.* 1360-1455), of Vaṭaśreṇi
(Mal. Vaṭaśśeri) house in the Aśvattha-grāma (Mal. Ālattūr),
pupil of Mādhava, Nārāyaṇa and Rudra.

    —*Ācārasangraha* I

    —*Goladīpikā* I

    —   Do. II

    —   Do. III

    —*Grahananyāyadīpikā*

    —*Grahanamandana*

    - *Grahanāṣṭaka*

    —*Candracchāyāganita*

    —*Jātakapaddhati*

    —*Dṛgganita*

    —*Vakyakaraṇa*

    —*Vivāhānukūlyam*

    —*Ṣaḍvargaphalam*

    —C *Bhaṭadīpika* on the *Āryabhaṭīya*

    —C *Vivṛti* on his own *Goladīpikā* I

    —C on the *Jātakakarmapaddhati* of Śrīpati

    —C *Parameśvarī* I on the *Praśnaṣaṭpañcaśika* of Pṛthuyaśas

Parameśvara I (contd.)

—C *Karmadīpika* on the *Mahābhāskarīya* of Bhāskara I

—C *Siddhāntadīpikā* on the *Mahābhāskarīya-bhāṣya* of Govindasvāmin

— C on the *Muhūrtaratna* of Govinda Bhaṭṭatiri

—C *Pārameśvara* on the *Laghubhāskarīya* of Bhāskara I

—C *Pārameśvara* on the *Laghumānasa* of Muñjāla

—C *Vivaraṇa* on the *Līlāvati* of Bhāskara II

—C on the anon. *Vyatīpātāṣṭaka*

—C *Vivaraṇa* on the *Sūryasiddhānta*

—C *Dīpika* on the anon. *Muhūrtāṣṭaka*

—C *Bhādīpikā* on an unidentified work

—C *Vākyadīpika* on an unidentified work

Ref. See above, pp. 2ff, 19-20; 52-54, § 23; K.V. Sarma, Intro. to his edns. of P's works ; Raja, 136-43 ; Sen, pp. 166-70 ; UI. II. 100-5 ; UI. Sup. I. 212-19 ; Va I. 378-83.

Parameśvara II

—C *Pārameśvarī* (II) on the *Praśnaṣatpañcaśikā* of Pṛthuyaśas.

—C *Pārameśvarī* or *Horābhiprāyanirṇayā* on the *Horā.*

Ref. See above, p. 73, § 61.

Parameśvara III, disciple of Śaṅkara.

—C *Jātakacandrika* or *Viśvavṛthadīpinī* on the *Horā*

Ref. See above, p. 73, § 62.

Parameśvara IV : Parameśvaran Nampūtiri of Puradahanapura (Mal. Purayannūr) family, c. 1775-1839; pupil of Agnidattan Nampūtiri.

—*Aṣṭamijayantīnirṇaya.*

— C *Varadīpika* on *Muhūrtapadavi* II.

Ref. See above, pp. 76-77, § 72; UI. III. 476-77; Va. II. 605-12.

Parameśvara V : Parameśvaran Potti of Vāzhamaveli house in Chengannoor; renowned astronomer-astrologer and teacher of the prolific writer Śaṅkaran Nampūtiri of Mahiṣamaṅgalam.

Ref. See above, pp. 62-63, § 37; p. 64, § 38.

Parameśvara VI, (c. 1775-1825), astronomer; teacher of Ghaṭīgopa.

Ref. See above, p. 77, § 74.

Paralperu (arith.), Skt.-Mal., Anon.   Ms.   C. 13-B (65 gr.)

Parahitam or *Grahacāranibandhanam* :   See *Grahacāranibandhanam*.

Parahitakaranam (kar.), Anon.   Ms. 5820 C.

  Do.—C (Mal.), Anon.   Ms.   5820-C.

Parahitakhandah (kar.), Anon.   Ms. 11044-S (6 gr.; M.E. 948).

Parahitaganitam (kar.), Anon.   Ms. 411-B-1, 13300-F, L. 1248-I.

Parahitavyākhyaganita (kar.), Anon.   Mss.   Ad.; Sarasvati Mahal Library, Tanjore.

Parahitadijyah (kar.), Anon.   Ms. L. 1076-B.

[Parasarahora (astrol.)]

    —C *Prakatārtha* or *Sampradāyapradīpika* by Govinda-svāmin.

  Mss.   Sarasvati Mahal Library, Tanjore, D. 11498, D. 11499; Or. Res. Inst., Mysore, 3166.

Palisa-slokannal (calculation of interest), by Putumana Somayāji.

  Mss.   C. 2314 (folio 74), C. 2470 (folio 98).

Patu ganippan Bhāṣā :   See C (Mal.) on *Vyatīpātavaidhṛta*.

Patum pirappum (kar.), Mal. verse, Anon., 20 gr.   Ms. L. 251-B.

Pathya :   Name of anon. C on *Horā*.

Putumana Somayāji (c. 1660-1740), native Śivapura (Trichur).

    —*Karanapaddhati*

    —*Ganitagrantha*

    —*Grahanaganita* I

    —*Grahanāstaka* II

    —*Jātakadesamārga* I

    —   Do   II

    —*Nyayaratna* I

    —   Do.   II

    —*Pañcabodha* III

Putumana Somayaji (contd.)

—*Paliśa-ślokaṅṅaḷ* (Mal.)

—*Veṇvarohaṣṭaka*

—C (Mal.) on the *Laghumānasa* of Muñjāla

Ref. See above, pp. 68-69, § 49; K.V. Sarma, 'P, an astronomer of Kerala and his hitherto unknown works', *Proc. of the 18th All-India Or. Conf., Annamalainagar,* 1955, pp. 562-64. Intro. to *Karaṇapaddhati,* (Madras, 1956), pp. xxi-xxxi ; Raja, 162-65 ; Ul. II. 107-9 ; Ul. Sup. I. 212-15 ; Va. I. 529-31.

Purayannūr Namputiri : See Parmeśvara IV.

Puruṣottama I, Māttūr Nampūiri, *c.* 1475-1535.

—*Muhūrtapadavī* II

Ref. See above, pp. 61-62, § 34.

Puruṣottama II, *c.* 1675-1750.

—*Pañcabodha* IV or *Pañcabodhaśataka*

Ref. See above, pp. 67-68, § 48.

Puruṣottama III : Puruṣottaman Mūssatu, (*c.* 1850-1900), of Kūttaleṭattu family, pupil of Bhāskara, Śaṅkara, Vahni and Nārāyaṇa, and grand-disciple of the au. of *Praśnamārga.*

—*Praśnāyana*

—C on his own *Praśnāyana*

Ref. See above, pp. 79-80, § 79.

Pulimukhaṭtu Poṭṭi (1686-1758), astrological authority.

Ref. See above, p. 5.

Purṇaprajña- or Pūrṇaprabodha- Śiṣya,

—*Kālaprakāśika*

—C (X) (Mal.) on *Hora*

Poruṭṭam I (astrol.), Anon.

Beg. yadyatphalam narabhave kṣamam aṅganānām
tattad vadet patiṣu vā sakalam vidheyam /
teṣām tu bhartṛmaraṇam nidhane vapuś ca
lagnendugam subhagatāstamaye patiś ca //

Ms. CM. 6-B.

Do.—C (Mal.). Beg. itinnupadeśamāvatu— yadyat yātorikkal.

Ms. CM. 6-B.

Poruttam II (astrol.), Mal.-Skt., 100 gr.

Beg.   jāto janmatrayāt strīṇām vipat pratyaranaidhane (?) /
varjyo'trāpi viśeṣeṇa kuvedāgnyaṁsajaḥ kramāt //

Ms.   CM. 173-B.

Poruttam cārttum prakāram (?) (astrol.), (Mal.), Anon.

Beg.   naṭe rāśipporuttatte nirūpikka—
strījanmato raṇṭatha mūnnum añcum /
ārum vivarjjikka śubho'nyarāśau //

Ms.   CM. 4147-D.

Prakaṭartha :   Name of C by Govindasvāmin on *Parāśarahorā*.

Prakāśalatika or *Dviśatī* :   See *Dviśatī*.

Prakāśika :   Name of C by Nityaprakāśa Yati on *Horā*.

Prakīrṇasaṅgraha (kar.) :   Same as *Pañcabodha* I, with certain
differences.   Mss. See *Ker.*, II. p. 156.   Ref. Va. III. 390-96.

Prathamārtavādiphalam (astrol.), Mal. prose, Anon.   Ms.   5820-D.

Praśnacintā (pra.), Anon., Skt.-Mal.

Beg.   ravyuccāsṛktamomandacandrajñaguravaḥ kramāt /
prāgādyaṣṭamadiksthānāt prārabdhārkodayāditaḥ //
......santatipraśnam nirūpippān...

Ms.   T. 144-D (b)

Praśnajñanam or *Praścalāñchanam* :   See *Praśnalāñchanam*.

Praśnapaddhati (pra.), Anon.   Ms. Vayaskara Illam, Kottayam,
92-A.

Praśnaprakāśika I (pra.), Mal. prose-verse, Anon., in 7 chs., 1150 gr.

Beg.   vande'hām girijāsūnum jñānamūrtim gurūn grahān /
Praśnaprakaśikām vakṣye bālakānam hitāya vai //

Mss.   C. 554, T. 326.   Ref. Ul. III. 242.

Praśnaprakāśika II (pra.), Mal. prose, Anon.   Ms. 3383-F.

Praśnaphalam I (pra.), Mal. prose, Anon.   Ms. T. 144-B.

Praśnaphalam II (pra.), Mal. verse, Anon.   Ms. 3383-B.

Praśnaphalaprāptikalanirṇaya (pra.), by a disciple of Kṛṣṇa.

Beg. Kṛṣṇācāryamatam samyak paryālocya punaḥ punaḥ /
prastuh praśnānusāreṇa phalam vācyam vipaścitā //
atha *Praśnaphalaprāpteḥ* kathyate *Kālanirṇayaḥ* /

End : Kṛṣṇācāryasya śiṣyeṇa Horāṇām upapāditā /
Kṛṣṇacāryaprasādena prasādāc ca vivasvataḥ //
Kṛṣṇācāryopadiṣṭārthaḥ yeṣām manasi vartate /
avyāhatamatis teṣām phalabhāge pravartate //

Ms. Ms. D. 13950.

Praśna-Bhāṣā I (pra.), Mal. verse, Anon.

Beg. mattebhāsyam praṇamyādau bhāskarādīn grahān gurūn /
Praśnabhāṣām pravakṣyāmi balānam arivān aham //

Mss See *Ker. Mal.*, pp. 89-90 ; CM. 563-F, PM. 4026-E. Edn.
Śrī Vanchi Setu Lakshmi Series, No. 4, Trivandrum, 1926.
Ref. Va. III. 383.

Praśna-Bhāṣā II (pra.), Skt.-Mal., Anon. Mss. 3671-E, 5095 B,
5780-A.

Praśnamārga I (pra.), by a member of the Panakkaṭṭu or Iṭakkāṭṭu
Nampūtiri family, (c. A.D. 1650), in 32 chs., 400 gr.

Mss. See *Ker.*, II. pp. 177-78. Edn. Punnaśśeri Nīlakaṇṭha Śarmā,
Trichur, M.E. 1104. **Ref.** Ul. III. 87-89 ; Va. III. 400-5.

Do.—C. I, *Durgamārthaprakāśinī*, by the author himself. Mss. Ker.
II. p. 178. **Ref.** Ul. III. 89 ; Va. III. 400-5.

Do.—C II (Mal.), Anon.

Beg. ...vedattinte cakṣussallo i śāstramākunnatu. atukoṇṭu
aṅgaṅṅaḷil i śāstram pradhānam ennu vannū.

Ref. Va. III. 405.

Do.—C III (Mal.), by Āzhvāñceri Tamprākkaḷ, included in his
Phalasārasamuccaya (*Praśnabhāga.*).

Do.—C IV (Mal. rendering), being chs. I-XII of the *Praśnarīti* of
Iṭakkaṭṭu Kukkaṇiyāḷ.

Praśnamārga II (pra.), Mal. prose, Anon. Ms. L. 1100-B.

Praśnamarga III (pra.), Mal. verse, Anon., 1000 gr. Ms. T. 155.

Praśnamarga : See also *Laghu-Praśnamarga*.

Praśnamāla (pra.), Anon., by Śankara of Mahiṣamangalam.

> **Beg.** vande girīśam girijāsametam... (1) ;
>
> praṣṭuḥ svabhāvekṣaṇaveṣabhāṣā... (2)
>
> **Ms.** TM. 213.

Do —C (Mal.), Anon., possibly by the author himself.

> **Beg.** jātakasārannaḷilum   praśnasārannaḷilum   bhūtalakṣaṇam nimittam...
>
> **Ms.** TM. 213. **Ref.** Ul. III. 242. **Rem.** The Skt. text and the Mal. C have only a common *mangala-śloka*.

Praśnaratna (pra.), Anon., 350 gr., (Ker. ?)

> **Beg.** yatsvātantryakalākālaścillavo jyotiṣām gaṇaḥ /
>
> candrapūṣamadaḥ pūrṇacidānandam aham śraye //
>
> **Mss.** *Ker.*, II. p. 179.

Praśnarīti I (pra.), by Dāmodaran Nampūtiri of the Mangalaśśeri house.

> **Ref.** Va. III. 379.

Praśnarīti II (pra.), (Mal. verse), by Iṭakkāṭṭu Kukkaṇiyāḷ, 17th cent., in 20 chs. **Mss.** See *Ker. Mal.*, p. 90. Edn. in the Mal. monthly *Kavanodayam*, (Kozhikode). **Ref.** Ul. III. 236-37 ; Ul. Sup. I. 536 ; Va. III. 405-6.

Praśnalakṣaṇam I (pra.), Skt.-Mal., Anon. **Ms.** 13494-F.

Praśnalakṣaṇam II (pra.), Mal. prose. Anon. **Ms.** 13042-D

Praśnalakṣaṇam III (pra.), Mal. prose, Anon. **Ms.** L. 331.

Praśnalāñchanam or *Praśnajñānam* (pra.), Skt.-Mal., Anon., 294 vv.

> **Beg.** ravicandrabhaumasomajasuraguruśukrārkajādikān natvā /
>
> vakṣye *Lāñchanarūpam Praśnajñānam* hitāya daivavidām //
>
> **Mss.** 6007-G, 14294-N, L. 327-D. **Ref.** Va. III. 387-88.

[*Praśnaṣaṭpañcaśika* (pra.), by Pṛthuyaśas].

Do.—C I, *Parameśvarī*, by Parameśvara I, 300 gr.

> **Beg.** namaskṛtya gaṇeśānam... (1) ; tatra prathamam kendra-catuṣkasya sankṣepād viṣayabhedān āha.
>
> **Mss.** 5963. 12235, C. 2132-B, T. 612.

Praśna ṣaṭpañcāśika (contd.)

Do.—C II, *Paramesvarī*, by Parameśvara II, 330 gr.

Beg. keśajārkaniśakarān kṣitijavijjīvāpnujitsūryajān ...

lokānam hitakāmyayā dvijavaraṣ ṭikām karoty ujjvalām //

Mss. C. 652-A, T. 962.

Praśnasaṅgraha, Praśnasārasaṅgraha or *Sārasaṅgraha* (pra.),
Anon.

Beg. sūryendvagnivilocanam ... Cellūranātham śivam (1) ;

Madhyāṭavyadhipam pịaṇamya kamalam ... (2) ;

skandheṣu triṣu saśramaḥ kṛtamanāḥ ... (3)

Ms. Whish, 144 (1).

Praśnasāra I (pra.), by Mādhava of Iñcakkạzhvā family, in 16 chs.,
960 gr., A.D. 1543. **Mss.** C. 2139-B, C. 2478-A. **Edn.** *Sri Vanchi
Setu Lakshmi Series*, No. 11, Trivandrum. **Ref.** Ul. II. 475-77.

Praśnasāra II (pra.), by Śaṅkara, in 4 chs. (Skt.-Mal.)

Beg. daivajñopahito'tha deśasamayau ...

Mss. 10582-A, CM. 565-F, PM. 4168.

Do.—C (Mal.), Anon., possibly by the author himself. Mss. 10582-A,
CM. 565-F, PM. 4168.

Praśnasāra III (pra.), by a Somayāji of Bhūtanāthapura, pupil of
Vaidyanātha. **Mss.** 2745, 12810-A, C. 2007-D, T. 876.

Praśnasārasaṅgraha : See *Praśnasaṅgraha*.

Praśnasārasamuccaya (pra.), Anon.

Beg. praṇipaṭya gaṇeśānam jñānamūrtim divākaram /

*Praśna*śāstram samālokya vakṣye *Sārasamuccayam* //

Mss. P. 896, P. 897, P. 898.

Do.—C (Mal.), Anon.

Beg. praṇipatya ... ennatin poruḷ—aham gaṇeśānam praṇipatya
Sārasamuccayam vakṣye.

Ms. P. 898.

Praśnadarśa or *Jñānapradīpikā* : See *Jñānapradīpikā*.

Praśnānusthānam (pra.), Anon.

Beg. padabhāvaguṇā senā ramyaghnā hinabhā dalā /

Ms. CM. 543-A.

Do.—C (Mal.), Anon. **Ms.** CM. 543-A.

Praśnānusthanapaddhati I (pra.), Anon., probably by Śaṅkara of the next entry, 720 gr.

Beg. astu trailokyadīpāya bhaktābhimatadāyine /

samastavidyānirmāṇakavaye ravaye namaḥ //

svasthacitto viviktasthaḥ samabhyarcya gaṇādhipam /

nijān gurūn devatāś ca sūryādiṁś ca navagrahān //

Mss. 722-A, 10582-B, C. 632-C, C. 733-B, TM. 36. **Ref.** Ul. Sup. I. 223-24.

Praśnānusthanapaddhati II (pra.) by Śaṅkara, in 24 chs., Possibly, an enlarged version of the previous work, *Praśn°* I. 1550 gr.

Beg. astu trailokyadīpāya (as above) (i) ;
prātarvidhim vidhivad eva vidhāya pūrvam
kṛtvā punar japavidhim gaṇanam grahāṇām /

Mss. 4162-A, 6121-B, 6126, C. 962-C, C. 2066-A, L. 839, P. 899, P. 900. T. 36. **Ref.** Ul. Sup. I. 223 ; Va. III. 386-87.

Praśnāmṛta (pra.), by Śrīkumāra, son of Nīlakaṇtha and pupil of Nārāyaṇa, of the village of Dvipakānana (? Mal. Ānakkāḍ), in 6 chs., 400 gr. **Mss.** 1154 C, 3671-C; Whish 118 (2)

Praśnāyana (pra.), by Puruṣottaman Mūssatu, in 15 sns., A.D. 1881. **Mss.** 15084, T. 955. **Edn.** *TSS* 233 (with C), Trivandrum, 1968. **Ref.** Ul. Sup. I. 225.

Do.—C, by the author himself. **Mss.** C. 721, T. 955. **Edn.** *TSS* 223, above. **Ref.** Ul. Sup. I. 225.

Praśnārūdhadinirūpaṇam (pra.), Mal. prose, Anon. **Ms.** 13294-B.

Praśnopadeśa I (pra.), Old Mal. prose, Anon.

Beg. rogapraśnamāvitu—guḷikane vaccu...

Ms. PM. 4169 (412 gr.)

Praśnopadeśa II (pra.), Mal. prose, Anon. **Ms.** 14218-B.

Prasavādipraśnaphalam (pra.), Mal. prose, Anon., Ms. L. 336. E.

[*Phaladīpikā* (astrol.) by Mantreśvara :] C (Mal.), Anon. Ms. C. 2226-B.

Phalanirṇaya (astrol.) : See *Vārādiphalanirṇayaḥ*.

Phalasārasamuccaya (astrol.), by Āzhvañceri Tamprākkaḷ.
Ms. L. 1249-A (inc., 150 gr.), in three sections devoted to *Jātaka*, *Praśna* and *Muhūrta*.

Do.—C (Mal.), *Bhāṣā*, by the author himself. Mss. *Jātaka* sn. : L. 1215, T. 132-A, (9000 gr.) ; *Praśna* sn. : C. 198, L. 1216, L.1350-A, (5000 gr.) ; *Muhūrta* sn. : T. 132 B, C, (7000 gr.)

Bālabodhinī or *Bālaprabodhinī* : Name of anon. C on the *Jātakapaddhati* of Parameśvara.

Bālarāman Piḷḷa (19th cent.), of Nālekāṭṭil family, astrological authority. **Ref.** See above, p. 5.

[*Bṛhajjātaka* (jr.) by Varāhamihira : See *Horā*].

Bhagaṇahārakādivākya (kar.), Mal. prose, Anon. Ms. 13230-A.

Bhadradīpagaṇita (kar.), (Mal.), by Iṭakramañceri Nampūtiri, in 11 chs., *c.* A.D. 1665. Mss. See *Ker. Mal.*, p. 98. **Ref.** Ul. III. 232-34 ; Ul. Sup. I. 534-35.

Bhadīpikā (astron.), C (?) on an unidentified work by Parameśvara of Vaṭaśreṇi. Men. by him at the close of his C on the *Mahābhāskarīya*.

Bhāradvāja-dvija, (*c.* 1750-1850).
— *Karaṇadarpaṇa*
— *Gaṇitayuktayaḥ*
Ref. See above, pp. 73-74, § 63.

Bhāvacintāvalī (astrol.), by a pupil of Citrabhānu
Beg. natvā gaṇeśvaram vāṇīm *Citrabhānum* gurum grahān /
bhaktyā vilikhyate kiñcit *Bhāvacintāvalī* mayā //
Ref. Raja, 154 (°*cintāmaṇi*, wrongly) ; Ul. II. 275.

Bhāvavicāra (astrol.), Anon., Skt.-Mal. Ms. Vayaskara Illam, Kottayam, List, 107.

[*Bhavadhyaya* (astrol.) : **Beg.** mūrtyādayaḥ padārthāḥ...]

—C (Mal.) : **Beg.** yātoru śāstrattiṅkal nintu yātoru grahattekkoṇtu mūrttyādikaḷāyirikkinta padārthaṅṅal...

Ms. PM. 4241. **Ref.** Ul. II. 263.

Bhaṣāgaṇitam (astron?), Mal. verse, Anon.

Beg. ādityan ādiyāyuḷḷa grahaṅṅaḷeyatennuvān /
bhāṣyāyittu collunnen atinuḷḷa kramaṅṅaḷe //

Ms. PM. 4368-E.

Bhaṣājyotiṣasaṅgraha : See *Jyotiṣasaṅgraha.*

Bhaṣāsaṅgraha : C by Vāsudeva on *Muhūrtapadavī* V.

Bhaskarīyagaṇita : Name of C XI on *Lilāvatī.*

Bhinnaṣṭavargopadeśa (astrol.), (Skt.-Mal.), Anon.

Beg. bhinnāṣṭavargopadeśam varutumāṟu collunnen ... nyūnam yatra phalam tena ...

Ms. GM. 565-1.

Bhūgolaṅṅayam (astron), (Mal.), by Iṭakramañceri Nampūtiri (?), 85 gr.

Beg. khamadhyato nilpitu bhūmi tante
kakṣyāntare dhāraṇa koṇtuṟaccu /
uruṇta nāraṅṅavad ākṛtim pūṇt-
'iśānaṭī' (1050) yojanatulyamadhyā // ...
bhūgoḷattinu naṭuve melkizhāyuḷḷa cuṭṭilum
nālu pattanam uṇṭallo nālu dikkilum iṅṅine // ...
ākāśagoḷamadhyattil ghaṭikāmaṇḍalasthith / ...
pādonaṣaṭkaramitam muḷayoṭṭu kiṟi
keṭṭiccamecc akalam ā(ṟ)api tōrayākki / ...
cemmeyuṇakkiy ivayokke varaṇtu vannāl
keṭṭiṭṭu goḷavum uṭan kramam ottu pinne // ...
mūnnañcayampoṭu nūṟu raṇtu kharago-
nakṣatrasaṅkhyāśvitaḥ /

Col. iti *Bhūgoḷaṅṅāyam.*

Ms. With K.V. Sarma.

Bhūtanāthapura Somayāji
—*Praśnasāra* III

Ref. See above, p. 76, § 68.

Bhūparīkṣā (nat. astrol.), Mal. prose, Anon.   Ms. 13494-Q.

Bhūmipporuttam (astrol.), Mal. prose, Anon.   Ms. 13020-F.

Bhṛgukerala : See *Śukrakerala.*

Bhojanādipraśnavicāra (pra.), Mal., Anon.   Ms. 13494-N.

Maṅgalaśreṇivipra-Śiṣya (17th cent.)

        —*Jyotiṣasaṅgraha* II (Mal.)

    Ref. See above, p. 66, § 44.

Maṅgalaśśeri Nampūtiri : See Dāmodara II,

Maccāṭṭu Iḷayatu : See Nārāyaṇa VI.

Maccāṭṭu Bhāṣā : See *Jyotiṣabhāṣāvalī.*

Madhyamādigaṇitam (?) (kar.), Mal.   Mss. See *Ker. Mal.,* p. 108.

Madhyamānayanagaṇitam (kar.), Skt.-Mal., Anon., 125 gr.
    Ms. 1025-G.

Madhyamānayanaprakāra (astron.), by-Mādhava of Saṅgamagrāma.
    Qn. in *Tantrasaṅgrāha* of Nīlakaṇṭha Somayāji.

Do.—C, Anon.
    Beg. 'vistṛtī'-tyādi, 'arkendvor'-ityādi-anayor ślokayor yukti-
        pradarśanāya …
    Ms. IO 6301 (ff. 16-18).

Maraṇavākya (astrol.), Mal. prose, Anon.   Ms. L. 1075-F.

Malamāsanirṇaya (astron.), Mal. prose, Anon.   Ms. L. 1229-B.

Malamāsavicāra (astron.), Mal. prose, Anon., 50 gr.   Ms. L.
    1229-C.

Mahājyādyānayanam (?), (astron.), (Mal.).   Ms. 13294-0
    (350 gr.)

Mahāyānayanaprakāra (?) (astron.), by Mādhava of Saṅgama-
    grāma.

Do.—C, Anon.
    Beg. 'nihatya cāpavargeṇa …', iṣṭacāpavargeṇa iṣṭacāpam, tat-
        phalāni ca nihatya …
    Ms. IO 6301 (ff. 12-16).

[*Mahabhaskariyam* (astron.), by Bhāskara I]

Do.—C I, *Bhāsya*, by Govindasvāmin. Mss. 5847, 12562-A, C. 1888-A. P, 903, P. 9+5, P. 977 (on ff. 59-98, not sep. catalogued), T. 844 ; Mad. R. 5138. **Edn.** by T. S. Kuppanna Sastri, *Madras Govt. Or. Ser.*, No. 130.

Do.—CC I, *Siddhāntadīpika*, by Parameśvara. Mss. 274, T. 931. **Edn.** With C, above.

Do.—CC II, by Sūryadeva Yajvan.

Ref. By Sūryadeva Yajvan himself towards the end of his C on *Laghumānasa* : "pūrvam mayā ... *Bhāskarācārya-Mahātantravivaraṇam Govindasvāmyam* prathamam vyākhyātam,*'*

Do.—C II, *Karmadīpika*, by Parameśvara.

Ms. Mad. R. 3842. **Edn** *Ānanadāśrama Skt. Ser.*, No. 126, Poona, 1945.

Do.—C III, *Prayogaracana*, Anon.

Beg. praṇamata śivam aniśam ... (1) ; kriyate *Prayogaracanā* ... (2) ; akṣarasaṃjñā jñeyā ... (3). kalām bibhartīti devatā-namaskāraḥ.

Mss. 8933-A, C. 166-I, C 2121-B, T. 176 ; Mad. R. 3034.

Mahamarganibandhanam (astron.), by Haridatta. Basic text of the Parahita system of Kerala astronomy. **Men.** In the au's. *Grahacāranibandhana,* III. 44.

[*Mahayātrā* (astrol.), by Varāhamihira]

—C by Sūryadeva Yajvan

Men. By Sūryadeva Yajvan himself at the close of in his C on *Laghumānasa* : "mayā...tato *Varahamihirakṛta Mahāyatrā* saṅkṣepeṇa vyākhyātā."

Mahiṣamaṅgalam Nāmpūtiri : See Śaṅkara III.

Māttur Nampūtiri-s of Pāñcāla-grāma (Mal. Paññāḷ), c. 1475-1535.

—*Muhūrtapadavī* II, by Puruṣottama

—*Muhūrtapadavī* III, by Subrahmaṇya

Ref. See above, pp. 61-62, § 34. See also Ul. II. 109-11 and Va. II. 601-2, where the two authors are not identified.

Mādhava : See also Vidyāmādhava.

Mādhava I, (c. 1340-1425), of Saṅgamagrāma near Cochin, teacher of Parameśvara of Vaṭaśreṇi.

—*Golavāda*

—*Madhyaṃanayanaprakāra*

—*Mahājyānayanaprakāra*

— *Lagnaprakaraṇa*

—*Veṇvāroha*

—*Śilam rajñaḥ śriyetyadi-viliptadivakyāni*

Ref. See above, pp. 16ff. ; 51-52, § 22 ; K.V. Sarma, Intro. to his edn. of *Veṇvāroha*, pp. 5-10 ; Raja, 133-36 ; Ul. II. 98-100 ; Va. I. 387-88 ; III. 388-90.

Mādhava II, of Īñcakkāzhvā, 16th cent., pupil of Govindamaṅgalam Nampi.

—*Praśnasāra* I (Mal.)

Ref. See above, p. 64, § 38 ; Ul. II. 475-77.

Mānasagaṇitam (astron), by Putumana Somayāji. Possibly, same as the C III (Mal.). *Mānasocitam*, on *Laghumānasa*, noticed below. Men. K. Rama Varma Raja, 'The brahmins of Malabar', *Jl. of. the Royal As. Soc.* (1910), p. 635.

Mānasocitam or *Mānasam eṇṇuṃ prakāram* : Name of C III (Mal.) by Putumana Somayāji (?) on the *Laghumānasa* of Muñjāla.

Mālinī-kṣipraprasna (pra.), Mal. prose, Anon. Ms. 14163-A.

[*Muṣṭiprasna* (pra.)]

Do.—C (Mal.), 35 gr. Ms. 8358-C.

Muhūrtakālaprakāśikā : See *Kālaprakāśikā*.

Muhūrtam Bhāṣā I (Muh.), Mal. maṇipravāḷa verse, Anon.

Mss. See *Ker. Mal.*, p. 113.

Muhūrtam Bhāṣā II (muh.), Skt.-Mal., Anon. Ms. 5033-C.

Muhūrtam Bhāṣā III (muh.), Mal. prose, Anon. Ms. 6007-C.

Muhūrtakaumudī (muh.), Mal. verse, Anon. Mss. 8345. T. 1173.

Muhūrtadarśana (muh.), by Vidyāmādhava of Nīlamana, in 15 chs.

Mss. *See Ker.*, II. pp. 313-14 ; Ad. ; Mad. ; Mysore.

Edn. Or. Res. Inst., Mysore, 3 vols., 1923-26. **Ref.** Ul. II.95 ;
Va. I. 443-44.

Do.—C I, *Dīpika*, by Viṣṇu, the author's son. **Mss.** C. 139, C. 337,
C. 2200, T. 225. **Edn.** With the text, above.

Do.—C II, *Bhavaprakaśa*, by Subrahmaṇya, 3300 gr. **Ms.** 8355.
Ref. Ul. Sup. I. 540 ; Va. I. 444.

Do.—C III (Mal.), Anon.

Beg. śriyam śrīgurupādābjapāṁsavaḥ pradiśanti vaḥ /

bhavanti bhavarāśer ye sukhottarahetavaḥ //

iti. *Muhūrttadarśanamākunna* prakaraṇatte camappān tuṭaññunna
ācāryan atioṭe ... 'jayatyameya' (text.) iti. savitā jayati—
oṭṭozhiyāte uḷḷa lokaññaḷuṭe prasūtikāraṇamāyuḷḷa ādityan ...

Mss. 420, 3761-A, 5853, 6043, 10921, 11083, C. 564. C. 2138,
C. 2140, C. 2515-A, T. 277.

Do.—C IV (Mal.), Anon.

Beg. jayatyameyāṁśu (etc.), (text). savitā jayati—ādityan
yallāyilum mel varttikkunnon. ellārakkāṭṭil prādhānyam
entenneṭattu collunnū.

Mss. CM. 564, P. 910.

Do.—C V (Mal.), Anon. Mss. 284, 621-B, 11010-A, T. 152.

Do.—C VI (Mal.), by Āzhvāñceri Tamprākkaḷ, incorporated in his
Phalasārasamuccaya (*Muhūrta* section).

Do.—C VII (Mal.), Anon., unidentified. **Ms.** Mad. D. 13594 (ch. II,
inc.)

Muhūrtadīpaka (muh.), by Nārāyaṇa, son of Keśava of Kāṇvavastu.

Mss. 1055-B, 5835-A, P. 911, P. 912. **Ref.** Ul. II. 107 ; Va. II.
612-13.

Muhūrtanirṇaya (muh.), (Mal.), Anon. **Mss.** T. 144-A, B.

Muhūrtapadavī I (muh.), ascribed to Govinda Bhaṭṭatiri of
Talakkuḷam. **Qn.** In C, *Varadīpika*, by Parameśvara IV on
Muhūrtapadavī II. **Ref.** Ul. II. 110.

Muhūrtapadavī II (muh.), by Puruṣottama of the Māttūr Nampūtiri family from Pañcālagrāma (Mal. Paññāl), in 36 verses.

Beg. pratyūhapraṇihantāram praṇipatya gaṇadhipam /
muhūrtāvagame mārgam rjum kartum yatāmahe //1//
ulkorvicalanoparāgaguḷikāḥ (etc.) //2//

End : V(B)rhadāvrti-gehasambhavena
dvijarājñā *Puruṣottamā*bhidhena /
gurunāthakrpābalāt krtam yat
tad idam sadviduṣām mude'stu nityam //   (Ms. IO 8070)

Mss. See *Ker.*, II. pp. 315-18 ; P. 914 ; IO 8070 ; Ad. Edn. C. K. Vasudeva Sarma, Kozhikode, 1952. Ref. Ul. I. 110-11 ; Va. II. 602-12. Authorship. See above, p. 61.

Do.—C I, *Dīpa* or *Muhūrtasaraṇī-dīpa*, Anon,

Beg. namāmi vighnarājam tam vighnarājanivrttaye / ... (1)
Muhūrtasaraṇī-dīpam sarvasamśayanāśanam /
vyākhyānam likhitum yatnam karomi janarañjanam //
(text) ulketyādi...

Mss. 3172-A, 3567, 3577-E, C. 1023-C.   Ref. Ul. II.111.

Do.—C II, *Varadīpikā*, by Parameśvara IV, of Puradahanapura (Mal. Purayannūr), A.D. 1815, 2000 gr. Mss. 5880, 13481-B, L. 397, T. 33, TM. 234 ; Ad. Edn. Trichur. Ref. Ul. III. 476-77 ; Ul. Sup. I. 627 ; Va. II. 605-12.

Do.—C III, Anon.

Beg. ulkorvi (etc.) ulkā alātapatanam. urvicalanam bhūmi-kampaḥ. etayor eko vā yasmin dine drśyate...

Ms. C. 1908-G.

Do.—C IV (Mal.), *Balaśankaram*, by Śankaran Nampūtiri of Mahiṣamangalam, A.D. 1540. Mss. See *Ker.*, II. p. 317 ; *Ker. Mal.*, p, 114. Edn. *Śrī Vanchi Setu Lakshmi Series*, No. 5, Trivandrum, 1926. Ref. Ul. II. 471. Note. Mss. 13329-A and L. 165-B contain more matter than in the edn. above.

Do.—C V (Mal.), by Citrabhānu-Śiṣyaͅ(?)

Beg. abhivādya gaṇādhyakṣam vāgdevīm ca gurūn grahān /
Muhūrtapadavīm eṣa bhāṣayā vyākaromy aham //

Muhūrtapadavī III, C V (contd.)

    iti. Muhūrtapadaviyām   granthatte   camappāṇ tuṭaṇṇuṇṇa ācāryan...

Mss. P. 924, P. 925, P. 926. **Authorship.** Suggested on the basis of the characteristic *maṅgala-śloka*.

Do.—C VI (Mal.), *Tamprākkal Bhāṣā*, by Āzhvāñceri Tamprākkal. **Edn.** Trichur.

Muhūrtapadavī III (muh.), by Subrahmaṇya of the Māttūr family, in 44 verses, 100 gr.

Beg.   pratyūhapraṇihantṛ kiñcana mahaḥ sañcintya bhāsām nidhim bhānum ca, kriyate *Muhūrtapadavī* saṅkṣiptaśāstrāntarā...(1)

    doṣalakṣaṇabalābalādikam... (2)

Mss. P. 913, P. 215 to 22-A. **Ref.** Ul. II. 110. **Authorship.** See above, p. 61, and C I, below.

Do.—C I (Mal.), Anon.

Beg.   'vṛddhimdheyāddhitāyā'sau ...padyair iyam kṛtā

    Muhūrtapadavī yena *Subrahmaṇyam* praṇaumi tam //1//

Mss. 12576, L. 865, L 1103-A, L. 5352-C ; Āzhvāñceri List, 81. **Note.** The gap in the above verse should have contained two letters, like *vagha* (°yāsā'vagha'°) denoting 44, being the number of verses in the work.

Do.—C II (Mal.), Anon.

Beg. aham kiñcana mahaḥ bhāsām nidhim bhānum ca sañcintya *Muhūrtapadavī* kriyate ity anvayaḥ.

Ms. PM. 4260-A.

Muhūrtapadavī IV (muh.), Anon., in 32 verses. **Ref.** Ul. II. 110.

Muhūrtapadavī V (?) (muh.), Anon.

Beg. cakrārdham mṛtivaidhṛtam ca guḷikaḥ
        sandhyāhimastam viṣam
gaṇḍāntam navadoṣaketujananam
        sāyāhnam ekārgaḷam /
saṅkrāntigrahaṇañ ca dagdham aśanir
        vṛṣṭyulkabhūkampanam
ṣaḍḍoṣam bahulañ ca yāmyam ayanam
        coṣṇañ ca śukrekṣaṇam //

Muhūrtapadavī V (contd.)

Mss. P. 894-C (cata. as *Jatakasāra-Keralabhāṣa*), P. 947-B (cata. as *Bhāṣāsangraha*).

Do.—C (Mal. verse), *Bhāṣāsangraha*, by Vāsudeva of Vaḷḷimana, in two versions of 178 or 185 verses, respectively.

Beg. jyotiśśreṣṭham aham vande sahasrakiraṇam ravim /
dineśam amarastutyam jaga- (broken) //
tumpayum tiṅkaḷum cūṭintappante mumpile makan /
mamānamukamuḷḷappan akalappōkkukāpadaḥ //
vakṣye namaskariccittu vijñātum bhūtanāthane /
bālānam pozhutum mātram *Bhāṣāsangraham* ity aham //

(text) : cakrārdham etc.

Mss. Version I in 178 verses : 13479-Q; version II in 185 verses : P. 894-C (cata. as *Jatakasāra-Keralabhāṣā*), P. 947-B (cata. as *Bhāṣāsangraha*), T. 153. **Note** : Ul. (II. 270, 473) takes this as an independent work on *muhūrta* by Śaṅkaran Nampūriti of Mahiṣamaṅgalam.

Muhūrtapadavī VI (muh.), by Tuppan Nampūtiri of Iṭavaṭṭikkāṭṭu family, in 40½ verses. **Ref.** Ul. III. 475-76.

Muhūrtapadavī VII (muh.), by Nārāyaṇan Nampūtiri of Iṭavaṭṭikkāṭṭu family, in 36 verses. **Ref.** Ul. II. 475-76.

Muhūrtapaddhati (muh.), Anon., (Ker. ?). **Ms.** 14045-B.

Muhūrtam Bhāṣā, *Muhūrtavidhi* or *Tamaranallūr Bhāṣā* (muh.), (Old Mal.), by a member of the Tāmaranallūr family and protégé of Ceyyūr (? Cellūr) Nārāyaṇan Nampūtiri, 300 gr.
Mss. 151-B, 515-A, 5835-C, 5839, PM. 4113-B, PM. 4147-A, (the last two cata. as *Muhūrtapadavī-Bhāṣā*). **Ref.** Ul. I. 400-1 ; Ul. Sup. I.146 ; Va. III.396.

Muhūrtamādhavīya : See *Muhūrtadarśana*.

Muhūrtaratna (muh.) by Govinda, in 4 chs. **Mss.** See *Ker.*, II. p. 318 ; Mad. **Ref.** Va. II. 499-500.

Do.—C by Parameśvara of Vaṭaśreṇi. **Mss.** 5853-B, C. 138, T. 144 A-B. **Ref.** Va. II. 500, where it is wrongly stated that the author is different from P of Vaṭaśreṇi.

Muhūrtalakṣaṇam I (muh.), Anon. Ms. 865-B.

Muhūrtalakṣaṇam II (muh.), Mal. prose, Anon., Ms. T. 144-C-4.

Muhūrtalīñchanam (muh.), Mal. prose, Anon., 100 gr. Mss. 1134-D, L. 1352-E.

Muhūrtavicāra (muh.), Mal. prose, Anon. Ms. L. 899-A.

Muhūrtavidhi I (muh.), Mal. prose, Anon. Ms. L. 139-B.

Muhūrtavidhi II (muh.), Mal. verse, Anon. Ms. L. 398.

Muhūrtavidhi : See also *Muhūrtam Bhāṣā*.

Muhūrtabharaṇa (muh.), by Dāmodara of the Bhāradvāja gotra, in 9 chs., 1000 gr. Mss. T. 240, TM. 71. Ref. Ul. II. 105-6; Ul. Sup. I. 210-11.

Muhūrtaṣṭaka (muh.), Anon., 20 gr.

    Beg. Jyeṣṭhāśleṣāgnirakṣohara (etc.)

    Mss. 1055-H, P. 865, P. 866.

Do.—C I, *Ācāradīpika*, in verse, by Ravi, 130 gr.

    Mss. See *Ker.*, II, p. 319; P. 865, P. 866. Ref. Ul. II. 113-14.

Do.—C II, *Dīpikā*, by Parameśvara of Vaṭaśreṇi.

    Men. By him at the close of his C on the *Mahābhāskarīya*.

Maudhyadigaṇitam (?) (kar.), (Mal.) Mss. *Ker. Mal.*, pp. 116-17.

Yātrāphalam (astrol.), Mal. verse, Anon., 20 gr. Ms. 5038-D.

Yātrāmuhūrta (muh.), Mal. prose, Anon., Ms. 10752-P.

Yuktibhāṣā or *Gaṇitanyāyasaṅgraha* (math.-astron. rationale), by Jyeṣṭhadeva, in two parts : Pt. I. Mathematics and Pt. II. Astronomy. 5350 gr. Mss. See *Ker. Mal.*, p. 48 (cata, *Gaṇitanyāyasaṅgraha*), p. 117. Edn. with Notes by Rama Varma Maru Thampuran and A. R. Akhileswara Ayyar, Trichur, 1948; (Pt. I only); With Notes, K.V. Sarma (Pt. II only) ; Gov. Or. Mss. Library, Madras, 1954. Skt version : See *Gaṇityukti*, Mad. R. 4382. Ref. Raja, 157-58 ; Sen, p. 73 ; Ul. III. 439-40 ; Ul. Sup. I. 612-16.

Yogaphala (astrol.), Mal. prose, Anon. Ms. 13494-J.

Yogadiphalam (astrol.), Mal. prose, Anon. Ms. 5109-G.

Yogyadividhi (astron.), Skt.-Mal., Anon. Ms. 13241-G.

Raṇadīpikā (astrol.), by Kumāra Gaṇaka, in 8 chs. Ms. C. 531-D.

Qn. in *Praśnamārga* (A.D. 1650). Edn. *TSS* 95. Ref. Ul. II. 112-13 ; Va. II. 725-29.

Ravi, (*c.* 1425-1530), Teacher of Nilakaṇṭha Somayāji.

—C *Ācāradīpikā* on *Muhūrtāṣṭaka*

Ref. See above, p. 55, § 25 ; Ul. II. 113-14.

Ravisaṅkramādigaṇitam (?) (astron.), Mal., Anon. Ms. 6132-B (200 gr.).

Rājarāja Varmā I : Vidvān Karīndran Ceruṇṇi Koyittampurān of Kilimanoor, (1812-46). **Ref.** See above, pp. 5-6.

Rājarāja Varmā II : A.R. Rajaraja Varma Koyittampurān, (1853-1918).

—*Karaṇapariṣkaraṇa*

—*Pancāṅgaśuddhipaddhati*

—C *Jyotiṣaprakāśana,* on the *Golādhyāya* of Bhāskara II.

Ref. See above, pp. 80-81, § 81 ; Ul. V. 791-827 ; Ul Sup. II. 436-49 ; Va. VI. 27-65.

Rāma I, Teacher of the anon. au. of *Laghuhorāvivaraṇa* (Mal.).

Ref. See above, p. 67, § 47.

Rāma II : Rāman Āśān (18th cent.), astrological authority, father of Kṛṣṇadāsa. **Ref.** See above, p. 5 ; p. 74 § 65.

Rāma-Śiṣya (17th cent.)

—C *Laghuorāvivaraṇa* on *Laghuhorā*

—C on *Horā*

Ref. See above, p. 67, § 47.

Rāmapraśna (pra.), Skt.-Mal., Anon. Ms. 13294-J.

Rāma Varmā Koyittampurān of Grāmam, (1853-1916).

—*Jyotiṣapradīpa*

Ref. See above, p. 80, § 80 : Ul. IV. 544-46:

Rāma Vāriyar of Kaikkulangara, (1853-97).

—*Gauḷiśāstram* (Mal.)

—*Sāmudrikaśāstra* (Mal.)

—C (Mal.) on *Horā*

—C (Mal.) on *Praśnamārga* (*Pūrvārdha*)

Ref. See above, p. 80, § 81 ; P.V. Krishna Variyar, life sketch, in Mal., in his book *Maṇ marañña sāhityakāranmār* ; Ul. IV. 267-76 ; Ul. Sup. II. 107-16 : Va. IV. 587-607.

Rāmāyaṇākṣarapraśna (pra.), Anon.   **Ms.** Paliyam List, 826.

Raśigolasphuṭānīti (astron. rationale), by Acyuta Piṣaraṭi.

Mss.   755 (cat. as *Gaṇitayuktayaḥ*) [G] (ff. 1-13) ; Mad. Mal. D. 339, pp. 90-95.   **Edn.** With Tr. K.V. Sarma, Adyar Lib., Madras, 1955.   **Ref.** Va. IV. 224-25.

Raśidvayānayanam (?) (arith.), Anon.

Beg.   rāśyor yogādighāto vargayogas tadantaram /

Ms.   L. 1354-F (inc., 110 gr., with a few instructions in Mal.)

Raśipramaṇādiphalam (?) (astrol.), Mal., Anon.

Beg.   pantraṇṭu rāśi vaccu ayanacalanam kūṭṭi ...

Ms.   L. 385-B.

Rāśiphalam (astrol.), Mal. prose, Anon.   **Ms.** 10717-C.

Rāśiphalasāropadeśa :   See under *Sāropadeśa.*

Rāśimānādigaṇīta (?) (astron.), Mal. verse, by Śaṅkara of Mahiṣa-maṅgalam.

Beg.   tumpa tiṅkaḷoṭu gaṅga tanneyum etc. (1) ;
candro rudro jayo vidyā nayas tena khanī raveḥ /
trimśannādyābni guḷiko dinapañcamavan niśi //
śrīvallabhaykku meṣādi rāśimānaṅṅaḷ collinen /
rāgaughamunimaunam hariṇakhariṇagānimān //

Ms.   C. 2297-C.

Rāśivarṇadivicāra (astrol.), Skt.-Mal., Anon.   **Ms.** 13194-E.

Raśisaṁjñadividhi (astrol.), Anon.   Ms.   13451.

Rudra I : Uzhutra Vāriyar, (c. 1325-1400), Teacher of Parameśvara of Vaṭaśreṇi.   **Ref.**   See above, p. 50, § 21.

Rudra II : Uzhutra Vāriyar, (c. 1475-1550).

—*Aṣṭamaṅgalaprašna*

—C *Naukā* or *Vivaraṇa* on Horā

Ref.   See above, p. 62, § 36 ;   Ul. II. 114-17 ;   Ul. Sup. I. 234-35 ; Va. I. 531-34.

Rekhāprašna (pra.), Mal.. Anon , 60 gr.

Beg.   maṇḍalajñanattiṅkalum anaṣṭye kelpāṁ mārkaṇḍanān paṇḍu pramerkupperapuranākum vasikkumeṭam (?)

Ms.   C. 1796-B.

Rekhaprašna (ārūḍha-pra.), Mal prose, Anon.   **Ms.**   T. 304-C.

Rogaprašna (pra.), Mal. prose, Anon.   **Ms.**   10582-C-1.

Rogalakṣaṇa-dūtalakṣaṇādi (pra.), Mal. prose, Anon.

Beg.   prašnam   vacca   rāśiyuṭe   aṣṭamādhipati   yātoru   rāśiyil ninnu ...

Ms.   PM. 4077-F.

Lakṣaṇaprašna I (pra.), Mal. prose, Anon.   **Ms.**   T. 1496.

Lakṣaṇaprašna II (pra.), Mal. verse, Anon.   **Ms.**   5109-C.

Lagnaprakaraṇa (astron.), by Mādhava of Saṅgamagrāma, 225 gr.
   Ms.   414-B, L. 1360-C ;   Mad. Mal. D. 339.

Lagnādiphalam (astrol.), Mal. prose, Anon.   **Ms.**   5109-E.

Lagnadyānayanam (astron.), Mal. prose, Anon.   **Ms.**   5109-K.

Laghukalārpaṇam (astron.), in 8 chs., 500 verses.

Beg.   māyām āśritya sṛṣṭvā   jagad idam akhilam svapnavat svasvarūpe.

Ms.   Mad. R. 5185 (a).   **Ref.** Va. 390-91.

Laghujātaka or *Laghuhorā* :   See *Laghuhara.*

Laghujatakapaddhati (jā.), Anon.

> natvādyam parameśvaram gaṇapatim ... (1)
>
> Kṛṣṇiyād aparāc ca sāram api ... (1) :
>
> janmāyuktaphalāni janmasamaye ... (2)

Ms. Whish 144 (2).

Laghudarśinī (astrol.), by Nārāyaṇa. **Ms.** 844-B.

Laghu-Praśnamārga (pra.), Anon. **Ms.** Payyalikkā Illam, Kottayam, 31-A.

[*Laghubhaskariya* (astron.), by Bhāskara I]

Do.—C I, *Vivaraṇa* by Śaṅkaranārāyaṇa. **Mss.** 4258, C, 1681, T. 277. **Edn.** *TSS* 162. **Ref.** Raja, 128-29 ; Ul. I. 165-67 ; Va. 221-23.

Do.—C II *Sundarī*, by Udayadivākara (Ker. ?), (A. D. 1073). **Mss.** C. 1885, P. 942-45 ; P. 977, T. 301.

Do.—C III, by Parameśvara of Vaṭaśreṇi. **Mss.** 8324-B, C. 1079-A, C. 1348-B ; T. 19 ; Ad. ; Mad. **Edn.** *Ānandaśrama Skt. Ser.,* 128, Poona, 1946.

Do.—C IV (Mal.), Anon.

Beg. karabadarasadṛśam akhilam bhuvanagatam yatprasādena.

Ms. P. 946 (inc.)

Do.—C V (Mal.), Anon.

End : grahagaṇitakarmmaṅṅaḷuṭe nibandham saṅkṣepeṇa Bhāskaraṇāl collapepeṭṭu kazhiññu.

Ms. 5157 (inc., 700 gr.).

Do.—C VI (Mal.), *Bālaśaṅkaram,* by Śaṅkara of Mahiṣamaṅgalam.

Ms. C. 2146-A (inc., 350 gr.). **Ref.** Ul. II. 471-72.

Do.—C VII (Mal.), Anon., 1500 gr.

Beg. ellārkkum uḷḷile nilkkum mānatteyum naṭappavan /
katiron ennabhiṣṭaṅṅaḷ ellāyppozhum varuttuka //

Mss. C. 1702, T. 286, T. 862. **Ref.** Ul. II. 650-51.

[*Laghumanasa* (astron.), by Muñjāla]

Do.—C I, *Vāsanā* or *Mānasagrahajñānavāsanā,* by Sūryadeva Yajvan, **Mss.** P. 949, T. 38.

Laghumānasa (contd.)

Do.— C II *Parameśvara*, by Parameśvara of Vaṭaśreṇi, 600 gr.

Mss. C. 760-B, T. 28 ; Ad. ; Mysore. **Edn.** *Ānandāśrama Skt. Ser.* , 123, Poona, 1944.

Do.—C III (Mal. prose), *Mānasagaṇitam* (?), *Mānasocitam* (?) or *Mānaasm eṇṇum prakāram*, by Putumana Somayāji (?)

Beg. gaṇeśā ninnu vandiccen *Mānasam* kathayākkuvān /

mandacetassukaḷkkellām pāṭham ākkām iteṇṭaham //

... *Mānasam eṇṇum prakāram*. abdam vaccu pattil perukki appaṭi vaccu eṭṭil koṇṭu mel kūṭṭuka.

Mss. 5129-D (inc., 120 gr.), E (inc , 75 gr.). **Authorship.** Suggested on the basis of the tradition that Putumana Somayāji has written a *Mānasagaṇita* and the similarity in the wording of the initial verse above with certain expressions like *alpacetasām* found in the initial verses of the other works of this author.

Laghumānasa : See also *Mānasa*.

[*Laghuhora* or *Laghujātaka* (astrol.), by Varāhamihira]

Do.—C, *Laghuhorāvivaraṇa*, free rendering in Mal. verse, by a pupil of Rāma, 500 gr., A.D. 1640. **Mss.** 719-A, P. 4320-A.

Lāñchanaśāstra I (pra.), Anon.

Beg. saccidānandarūpāṇām gurūṇām karuṇāvatā m / kaṭākṣapālyaḥ kurvantu satatam mama maṅgalam // ataḥparam mṛter lakṣma vakṣye tallāñchanais saha /

Ms. T. 7.

Lāñchanaśāstra II (pra.), by Śaṅkara : See *Sāmudrikasāra*.

Lāṭavaidhṛtagaṇitam (?) I (kar.), Mal. verse, Anon.

Beg. veṇṭunnerattinarkkendurāhūṇām sphuṭam ānayet /

Ms. L. 1328-D (inc., 100 gr.).

Lāṭavaidhṛtagaṇitam (?) II (kar.), Mal. prose, Anon.

Beg. lāṭavaidhṛtaṅṅaḷe gaṇikkum prakāratte collunnū—yātoru māsaṅṅaḷie ...

Ms· L. 1221-D (80 gr.).

Laṭavaidhṛtadigaṇita (?) I (kar.), Mal. prose, Anon.

Beg. lāṭavaidhṛtam eṇṇunna prakāram atha collinen /

Ms. 12687-F (130 gr.).

Laṭavaidhṛtadigaṇita (?) II (kar.), Mal., Anon.

Mss. 13294-A (180 gr.), C. 563-E (50 gr.), L. 638-B (550 gr.).

[*Lilāvatī* (arith.), by Bhāskara II]

Do.—C I, by Parameśvara of Vaṭaśreṇi. **Mss.** 5783, 10614-B, C. 295, P. 953 ; Ad. ; Mad. R. 5160.

Do.—C II, *Karmadīpaka, Karmapradīpikā* or *Kriyākramakarī*, by Nārāyaṇa : I. Shorter version, 2000 gr. **Mss.** 6069, 8978, 12806-A, C. 169, C. 306, C. 628-A, TM. 266 ; Ad. ; Mad. D. 13484, Mad. R. 3497. (The reading, "*etan Mādhavākhyena* racitam Karmadī-pakam", found in Mad. R. 3497, is an obvious interpolation, violating even the metre, in place of the normal reading "etan *Nārāyaṇakhyena*°."

Do.—C III, *Karmadīpaka, Karmapradīpikā* or *Kriyākramakarī*, by Nārāyaṇa : II. Longer version, 6750 gr. **Ms.** 12814, T. 200, Mad. D. 2754(a) ; **Ms.** with K.V. Sarma. Ref. Ul. Sup. I. 227-28.

Do.—C IV (Mal.), Anon., 2100 gr.

Beg yogāśrayam pāpaviyogahetukam
guṇālayam hāram aśeṣaduṣkṛtām /
kṛtīśvaram vedagirām param padam
ghanatviṣam gopakumāram āśraye //

iviṭe dravyattiṇṭe oro saṁjñakaḷe collunnū.

Mss. 1286-B, 5786, 2813, C. 7-A, C. 2334, L. 878-B, L. 1328, T. 15.

Do.—C V (Mal.), Anon.

Beg. abhipretārthasiddhyartham pūjito yas surair api /
sarvavighnacchide tasmai gaṇādhipataye namaḥ //
aham tam mātaṅgānanam natvā ...

Mss. 3636, L. 839.

Do —C VI (Mal.), Anon.

Beg. ācāryan iṣṭadevataye namaskariccu *Lilāvatiye* camaykkun-nuṇṭennu collunnū.

Mss. 14219-C (fr., 50 gr.), C. 1992-A (inc., 2000 gr.), L. 878-B.

Līlāvatī (contd.)

Do.—C VII (Mal.), Anon.

> **Beg.** varāṭakaṅṅal 20 kūṭiyatu oru kākiṇī.
>
> **Ms.** T. 850 (inc., 1500 gr.). **Ref.** Ul. III. 242-43.

Do.— C VIII (Mal.), Anon.

> **End :** avarkku ellāyppozhum sukham sampattu vardhikkunnū, *Līlāvatiyile* aṅkaparimāṇavyavahāram kazhiññu. Līlā-vatiyum kazhiññū.
>
> **Ms.** 10648 (inc., 200 gr.).

Do.—C IX (Mal.), Anon.

> **Beg.** na guṇo na haro na hṛtir na ghanaḥ pṛthulas tathā /
>
> **Ms.** 12559 (inc., 1200 gr.).

Do.—C X, *Bhāskarīyagaṇitavyākhyā*, by Goda Varmā, Vidvān Iḷaya Tampurān of Koṭuṅṅallūr. Men. Ul. IV. 31-32; Va. IV. 318 ; RNP IV. 400.

Do.—XI, by Dāmodaran Nampūtiri of Maṅgalaśśeri family.
Men. Va. III. 379.

Līlāvatī II (arith.), Mal. verse, Anon.

> **Mss.** 3637-C, 14219-C.

Vakramaudhyādigaṇitam (kar.), Mal. prose and verse, Anon. Epoch : Kali day 17,01,448 (A.D. 1557).

> **Beg.** ahargaṇatte vacciṭṭu 'devavākyajñasūrya'ne /
> kaḷañña śeṣam samskruddhair hariccāl śeṣamuḷḷatil //
>
> **Ms.** PM. 4368-H (80 gr.).

Vastrādiphalanirṇaya (?) (astrol.), Skt.-Mal., Anon.

> **Ms.** T. 120 (250 gr.).

Vararuci I (4th cent. ?), legendary promulgator of the *Kaṭapayādi* notation.

> —*Gīrṇaḥ śreyādi-Candravākyāni.*
>
> **Ref.** See above, p. 43. § 3; Rāja, 120-22, Ul. I. 77-81, 195; Va. I. 90-95.

Vararuci II, (Ker. ?), Apocryphal au (?)

—*Keraladvādaśabhāvavākyam*

—*Vararucikerala*, *Jātakarahasya* or *Keralanirṇaya*

—*Vārarucika*

— Certain other doubtful or apocryphal works.

Ref. See above, p. 43, § 4.

Vararucikerala, Jātakarahasya or *Keralanirṇaya* (astrol.) (Ker. ?)

Ref. Ul. I. 164, 165.

Vararucivākyam : See *Girnah śreyādi-Candravākyāni*.

Varṣalakṣaṇa (nat. astrol.), Skt.-Mal., Anon, **Ms.** 6914-A.

Vahni, (19th cent.), Teacher of Puruṣottama, au. of *Praśnāyana*.

[*Vākyakaraṇa* I (kar.), ascribed to Vararuci III]

—C (Mal.), Anon. **Ms.** L, 893-C.

Vākyakaraṇa II (astron. methodology) by Parameśvara of Vaṭaśreṇi, **75 gr.**

Beg. pūjyapādasya Rudrasya śiṣyo 'yam *Parameśvaraḥ* |

karoti *Vākyakaraṇam* vākyāvayavasiddhaye ||

Ms. C. 133-A.

Vākyadīpika (astron), by Parameśvara of Vaṭaśreṇi. **Men.** by him at the close of his C on the *Mahābhāskarīya*.

Vākyadhruvasaṁsākārādi (?) (kar.), Anon.

Beg. ānīya tuṅgamadhyendū vākyārambhadinodaye /

deśāntarākhyasaṁskāram api kṛtvā tayor dvayoḥ //

Ms. PM. 4147-E.

Vākyadhruvādigaṇitam (?) (kar.), Anon.

Beg. Candradhīlagnasaṁyuktam kollasaṅkhyāyutam kramāt /

Ms. PM. 4147-C.

Do.—C (Mal.), Anon.

Beg. 'candradhīlagna' ennu vaccu atil kollasaṅkhya kūṭṭi......

Ms. PM. 4147-C.

Vakyaśeṣam (kar.), Mal., mnemonic tables, Anon,

> Mss. See *Ker. Mal.*, pp. 130-31.

Vākyālaṅkāra (kar.), Anon., 'by a Brāhman', in 6 chs., 125 gr.

> **End** : *Vākyālaṅkāra*-nāmayam grantho viracito laghu :
>
> kenacid *dvijavaryeṇa* samāpto 'bhūd atisphuṭaḥ //
>
> **Ms.** C. 2179-B.

Vararucika (astrol.), by Vararuci, in 12 chs., 875 gr. **Mss.** P. 960,

> P. 961, T. 506.

Varādiphala (astrol.), Skt.·Mal., Anon. **Mss.** 13194-A, L. 385-C.

Varādiphalanirṇaya (astrol.), Anon.

> **Beg.** ātmajñāni sadāśūraḥ paittikaḥ priyavallabhaḥ |
>
> caturaśratanuḥ śrīmān ravivāre prasūyate //
>
> **Mss.** CM. 2197-B (cata. as *Vāraphalam* or *Pañcāṅgaphalam*),
> T. 245.

> **Do.—C** (Mal.), Anon.
>
> **Beg.** Vārādiphalanirṇayaḥ. ñāyarāzhcaphalam āvatu—ātmajñāni·
>
> **Ms.** T. 245.

Varādyadhipatinirṇaya (astrol.), Mal. prose, Anon. **Ms.** 6007-I.

Valmīkipraśna (pra.), Mal. prose, Anon. **Mss.** C. 2289, T. 1000.

Vālmīkiśāstra (pra.), Mal., Anon.

> **Beg.** ini nirūpicca kāryam śubhamo aśubhamo enṇu colluka.
>
> **Ms.** CM. 2293, **Rem.** For similar works see *Dṛṣṭāntamāla* I, II.

Vasiṣṭhapraśna (pra.), Mal., prose, Anon. **Ms.** 5974.

Vāsuṇṇi Mūssatu of Veḷḷānaśśeri, (1885-1914)

> —C on *Pañcabodha*.
>
> **Ref.** See above, p. 81, § 81; Ul. IV. 693-703; Ul. Sup. II. 373-75.

Vāsudeva I : Vāsudevasvāmī.

> —*Kalādīpa.*
>
> **Ref.** See above, p. 69, § 50; Va. III. 392-94.

Vāsudeva II, of Vaḷḷimana in Kaṇṇaṅgalam.

—C (Mal.), on *Muhūrtapadavī* V, in two versions.

Ref. See above, p. 72, § 58.

Vāsudeva III, teacher of the anon. au. of *Santānadīpikā.*

Vidyāmādhava, son of Nārāyaṇa, of Nīlamana, near Gokarṇa.

—*Muhūrtadarśana* or *Vidyāmādhavīya*

Ref. See above, pp. 48, § 15 ; Ul. II. 95 ; Va. I. 441-44.

Vidyāmadhavīya : See *Muhūrtadarśana.*

Vidvān Iḷaya Tampurān of Koṭuṅṅallūr, (1800-51)

—C *Bhaskarīya-gaṇita-vyakhya* on *Līlāvatī* of Bhāskara II

—C on *Golādhyāya* of Bhāskara II

Ref. See above, p. 78, § 75 ; Ul. IV. 31 ff. ; Va. IV. 318 ; RNP IV. 400.

Viliptādivākyāni : see *Śilam rājñah śriyetyādi°-*

Vivāhapporuttam (astrol.), Mal prose, Anon. **Ms.** 1416-C.

Do.—See also *Daśapporuttam, Poruttam, Vivāhānukūlyam, Veḷipraśna.*

Vivāhānukūlyam (astrol.), by Parameśvara of Vaṭaśreṇi. **Mss.** C. 584-A, T. 268-B.

Do.—C I, (Mal.), Anon.

Beg. rāśi-rāśīpavaśyau ... (text.). rāśivaśyavum rāśyadhipa-vaśyavum bandhuśatrutvavum ...

Ms. C. 584-A.

Do.—C II (Mal.), Anon.

Beg. anantaram vivāhattinu poruttatte paṟayunnu—rāśl-rāślpa-vaśyau ... (text). rāśipporuttavum rāśyadhipapporuttavum ennu tuṭaṅṅi eṭṭu poruttaṅṅal pradhānamāyiṭṭu collap-peṭunnu.

Ms. T. 268-B.

Viśvārthadīpinī : Name of C (IX) by Parameśvara on *Horā.*

Viṣamākṣaravivṛti : Name of C (IV) by Nityaprakāśa Yati on *Horā.*

Viṣunirṇayadiphala (astrol.), Skt.-Mal., Anon., 300 gr. **Ms.** L. 1229-E.

Viṣuphalādivicāra (astrol.), Mal. Anon., Ms. 1349 -P.

Viṣusaṅkramaphala (astrol.), Mal. verse, Anon., 150 gr. Ms. 6478-C.

Viṣṇu I

—C, *Caturasundarī*, on *Cintājñāna* of *Kṛṣṇīya* or Kṛṣṇa.

Viṣṇu II. son of Vidyāmādhava, of Nīlamana, near Gokarṇa.

—C, *Dīpikā*, on the *Muhūrtadarśana* of Vidyāmādhava.

Ref. See above, pp. 49-50, § 16.

Veṇād-dvija, personal name not known; a native of Veṇād (S. Travancore).

—*Jātakodaya* or *Uḍu-jātakodaya*

Veṇvāroha : See also *Candrasphuṭāpti, Dṛg-veṇvārohakriyā.*

Veṇvāroha (kar.), by Mādhava of Saṅgamagrāma, for the accurate computation of the moon, in 74 verses. *c.* 1400.

    Mss. 10929-C ; Skt. Col., Trippunithura ; Eḷamprakkoṭṭu Mana, Eravoor (Cochin), all with C of Acyuta.

    Edn. K.V. Sarma, with elaborate Intro., Skt. College, Trippunithura, 1956. **Ref.** Ul. II. 99-100 (where the work is wrongly described to contain only 59 verses) ; Va. III. 388-90.

Do.—C (Mal.), by Acyuta Piṣaraṭi. **Mss.** With the text mss. above.

    Edn. K. V. Sarma, with text above. **Ref.** Ul. II. 99-100, 651-52.

Veṇvārohakriyā (kar.), Anon. **Mss.** 5867, (ff. 163-65). **Edn.** K.V. Sarma, as App. II to his edn. of *Veṇvāroha*, above.

Veṇvārohāṣṭaka (kar.), by Putumana Somayāji. **Ms.** 404 (last folios).

Veḷipraśna (pra.), Mal. prose, Anon. Ms. C. 565 G.

Vaidyanātha-Śiṣya a native of Bhūtanāthapura.
    —*Praśnasāra* III.

Vaidhṛta : See also *Lāṭavaidhṛta, Vyatīpātavidhṛta.*

Vaidhṛta (?) (kar.), Mal., Anon., 80 gr. Epoch : Kali day 17,85,699 (AD. 1788).

Beg. vaidhṛtakali 'dhūḷikṣamī hi sevyaḥ'.

Ms. 14219-B.

Vaidhṛtagaṇita (kar.), Mal., Anon.

Beg. vaidhṛtam aṟiyum prakāram—oru grahaṃ meṣādiyāyi ...

Ms. 51C9-A (inc., 85 gr.).

Vaidhṛtādyanayanam (?) (kar.), Mal., Anon.

Beg. atātu māsam patinañcām tīyati udayattinṭe ādityasphuṭam vaccu raṇṭu tavaṇa ayanam kūṭṭi ...

Ms. 13494-I (180 gr.)

Vyatīpātagaṇitam (kar), Anon.

Beg. vyatīpātarkṣam abhūhya sāyanāhi-ravī nayet /
rāhos tu kṣepacalanam parakrāntim vidhor api //

Ms. CM. 595-F.

Vyatīpātavaidhṛta (kar.), Anon.

Beg. vyatīpātendusiddhyartham upāyo 'tha pradarśyate /

Mss. C. 595-E, C. 2085-E, L. 1167-A.

Do.—C (Mal.), *Paṭugaṇippāṇ-Bhāṣā*.

Beg. pātum piṛappum eṇṇeṇtil collunnuṇṭu curukki ñān /
iṣṭagrahayor arkan eṛunnāḷ udayattinu //
arkaṇil grahaṃ eṛuanāḷ eṇṇukastamayattinu /
mīnattil oruvan nilppu maṭṭevan meṣarāśiyil //

Mss. C. 595-F, C. 2085-E, L. 1167-A,   PM. 4078-D, PM. 4158-D.

Vyatīpātadigaṇita I (kar.), Anon.   **Ms.** 1015-A (200 gr.)

Vyatīpātadigaṇita II (kar.), Mal., Anon.   **Ms.** 13057-A (inc., 84 gr.)

Vyatīpātadigaṇita III (kar.), Mal., Anon.   **Ms.** 13389-A (inc., 115 gr.)

Vyatīpātāṣṭaka I (kar.), Anon. **Beg.** candra ... **Mss.** of the work are not known but that of its C is known.

Do.—*Vṛtti*, in verse, by Parameśvara of Vaṭaśreṇi. **Ms.** 788-D.

Vyatīpātaṣṭaka II (kar.), Anon.

Ref. Two verses beg. with *saṁskṛtyāyanayor bahvoḥ* and *visarpaś śaśibahor yat*, quoted by Nārāyaṇa in his C (I) on *Pañcabodha* IV, verse I. 2. It is not known whether *Vyatīpātaṣṭakas* I and II are the same.

Vyāghrapāda, apocryphal author.

—*Aṅkaṇaśastra, Grahasamaya* or *Navagrahasamaya*

Ref. See above, p. 47, § 11.

Śakabdasaṁskārakriyā (astron.), Mal., an exposition of *Karaṇapad-dhati*, I. 12, 13 depicting the *Śakabdasaṁskāra* of *Grahacāra-nibandhana*. Anon., 100 gr. Ms. 5820-C. Edn. App., (pp. 307-11), to the edn. of *Karaṇapaddhati*, Madras, 1956.

Śakunamuṣṭi : See *Dṛṣṭāntamālā*.

Śaṅkara I (c. 1475-1575), younger brother of Nīlakaṇṭha Somayāji of the Garga gotra, hailing from the Keḷallūr family. **Ref.** See above, p. 57, § 27.

Śaṅkara II : Śaṅkara Vāriyar (c. 1500-60) of Tṛkkuṭaveli family., follower of Nīlakaṇṭha Somayāji.

    —*Karaṇasāra*

    · C on Do.

    —C *Kriyākalāpa* on the *Tantrasaṅgraha* of Nīlakaṇṭha Somayāji

    —C *Laghuvivṛti* on the *Tantrasaṅgraha*

    —Anon. work on astron., quoted by himself in his *Laghu-vivṛti*, on *Tantrasaṅgraha*, II. 15, 16.

Ref. See above, pp. 58-59, § 31 ; Raja, 155 ; Ul. II. 120-21.

Śaṅkara III : Śaṅkaran Nampūtiri, (1494-1570), of the Mahiṣamaṅgalam (Mal. Mazhamaṅgalam) family, near Trichur, pupil of Parameśvara of Vāzhamāveli.

    —*Ayanacalanādigaṇitam* (Mal.)

    —*Kaladīpaka* I (shorter version) (Mal.)

    —*Kāladīpaka* II (longer version) (Mal).

    —*Gaṇitasāra* (II) (Mal.)

Srṅkara III (contd.)

—*Candroganitakrama* (Mal.)

—*Jatakakrama* (Mal.)

—*Jatakasāra* I (Skt.)

—*Jatakasāra* II (Mal.)

—*Pañcāṅga* (muhūrta) for 1000 years.

—*Praśnamāla* (Skt.)

—*Raśimānādiganita* (Mal.)

—C (Mal.) *Balaśaṅkaram* on *Kaladīpaka* II

—C (III) (Mal.) Do. on *Pañcabodha* IV

—C (IV) (Mal.) Do. on *Muhūrtapadavi* II

—C (VI) (Mal.) Do. on *Laghubhāskarīya*

—C (Mal.) *Pañcabodhakriyākrama* on *Pañcabodha* II

—C (II) (Mal.) *Pañcabodhārthadarpana* on *Pañcabodha* IV

—C (Mal.) on his own *Praśnamāla* (?)

Ref. See above, pp. 62-64, § 37 ; Raja, 155-56 ; Ul. II. 269-72 ; 469-75 ; Va. II. 613-22.

Śaṅkara IV of Muktisthala (Mal. Mūkkōla), pupil of Nārāyaṇa and Dāmodara, and protégé of the Zamorin of Kozhikode.

—*Āyuḥpraśna*

—*Sāmudrikasāra, Ārūḍhapraśna* or *Lāñchanaśastra*

Ref. See above, p. 75, § 66 ; Ul. III. 86-87 ; Va. II. 718-23.

Śaṅkara V

—*Jatakasāra* III (Mal.)

—*Praśnasāra* I (Mal.)

—*Praśnānuṣṭhānapaddhati* I (?)

—*Praśnānuṣṭhānapaddhati* II

Ref. See above, p. 75, § 67.

Śaṅkara VI, Teacher of the anon. au. of *Acāradarśana*.

Śaṅkara VII, (19th cent.), Teacher of Puruṣottama (au. of *Praśnāyana*).

Śaṅkara VIII, Teacher of Parameśvara, (au. of C IX, *Viśvārthadīpinī* or *Jatakacandrikā*, on *Horā*).

Śaṅkara IX : Śaṅkarakavi.

—C on *Muhūrtapadavi* III

Śaṅkaranārāyaṇa, (c. 825-900), court astronomer of King Ravi Varmā of Mahodayapuram.

—C *Vivaraṇa* on the *Laghubhāskarīya* of Bhāskara I

Ref. See above, p. 45, § 7 ; Raja, 128-29 ; Ul. I. 165-67 ; Va. IV. 221-23.

Śaṅkara-Varmā or Appu Tampurāṇ, (1800-38), a prince of the royal house of Kaṭattanāḍ in N. Malabar.

—*Sadratnamāla*

—C (Mal.) on Do.

Ref. See above, p. 78, § 76 ; Raja, 165-66 ; Sen, p. 191 ; Ul. III. 499-501 ; Ul. Sup. I. 635-37 ; Va. IV. 384-93.

Śilam rājñaḥ śriye'tyādi viliptādi-Candravākyāni (kar.) by Mādhava of Saṅgamagrāma. Mss. C. 2297-C, MC. 595-A, P. 4116-B ; Eḷamprakkoṭṭu Mana, Eravoor (Cochin). Edn. K. V. Sarma, with Notes, as App. I to his edn. of *Veṇvāroha*, Skt. College, Trippunithura, 1956.

Śukrakerala, Bhṛgukerala or *Keralarahasya* (Ker. ?). Ref. Ul. I. 164, 165.

Śuddhacandrādigaṇita (?) (kar.), Mal., Anon.

Beg. candrane sūkṣmamāyiṭṭu gaṇippāṇ kriya collinen /

Mss. 5812-B, 12686-C.

Śuddhacandrārkagaṇita or *Sūkṣmacandrārkagaṇita* (?) (kar.), Mal., Anon.

Beg. śuddhamāyi gaṇikkeṇṭū candrārkaṇmāreyeṅkilu /

Mss. 10856-E, 13225, 13294-L, 13298, L. 336-G, L. 1167.

Śubhāśubhanimittāni (nat. astrol.), Skt.-Mal., Anon.

Beg. guḷiko viṣṭi gaṇḍāntam viṣoṣṇaikārgaḷā amī /

varjyāḥ sarpaśiro lāṭo vaidhṛtaś ca sukarmasu //

Ms. C. 49-C (200 gr.)

Śyāmalavāraṇarāja, a prince.

—C on the *Kāladīpa* of Vāsudevasvāmi

Ref. See above, pp. 69-70, § 51 ; Va. III. 392-93.

Śrāddhacandrādigaṇana-kriyāsaṅgraha : See *Kriyāsaṅgraha*.

Śrāddhacandrādigaṇita I (kar.), Anon., misc. calculations, 1400 gr. Ms. 5812.

Śrāddhacandrādigaṇita II (kar.), Mal. prose, Anon. Mss. See *Ker. Mal.*, p. 148.

Śrīkaṇṭha of Veḷḷārakkaḍ in Cochin.

  —C (Mal.), on the *Jatakapaddhati* of Parameśvara (?)

Śrīkumāra, son of Nīlakaṇṭha and pupil of Nārāyaṇa, of the village of Dvipakānana (? Mal. Ānakkāḍ).

  —*Praśnāmṛta*

  Ref. See above, p. 76, § 70.

Śrīpatipaddhati : See *Jātakakarmapaddhati*.

Śrīvallabha, Teacher of the anon. au. of *Ācāradarśana*.

Ślokapañcāśikā (muh.), Anon. (Ker.?)

  Beg. gurum bhaktyā namaskṛtya tatprasadād yatāmahe /
           vivāhādipratiṣṭhāntakarmaṇām kālavittaye //

  Ms. P. 965.

Ṣaḍvargaphalam (astrol.), by Parameśvara of Vaṭaśreṇi. Mss. C. 133-B, T. 116-B.

Saṅkramadhruvānayana (kar.), Mal. prose, Anon., 40 gr. **Ms.** 13225-C.

Saṅkramadhruvānayanādi (?) (kar), Anon. Epoch, Kali year 4597 (A.D. 1495).

  Beg. 'sindhuśobho'nitābdaghne śāstrārthe jayanādikāḥ /
  Ms. L. 1328-E.

Saṅkrāntidhruvānayana (kar.), Mal. prose, Anon., 15 gr. **Ms.** 13294-F.

Saṅkrāntivākya I (kar.), Anon., 10 gr.

  Beg. āgāmi mitram vibudhākṛtinām /
           nanarta śaurir vanabhūratajñaḥ //
  Ms. CM. 595-G.

Saṅkrāntivākya II (kar.), Mal. prose, Anon. Ms. 12686-B.

Saṅkrāntisphuṭadigaṇita (?) (kar.), Mal. prose-verse, Anon. Epoch, Kali day 17,21,462 (A.D. 1613).

Beg. 'pritāsvādyarasāyano'ṟadivasān modāḍhyaputram tyajet.

Mss. 1005-C (inc., 130 gr.), L. 1175-C.

Saṅkrāntyadigaṇita (?) (kar.), Mal., Anon.

Beg. śṛṅgāṇi meror divi dhūpitāni
cakre ca śakro nava viśrutāni /
praṇauti rudram bhayavaṁśabhinnam
varam hi bhakto havi divyayānaṇ //

Ms. L. 1173 (160 gr.).

Saṅgrahasādhanakriyā (kar.), by Āzhvāñceri Tamprākkaḷ, 150 gr., on computaticn-procedures implied in his *Jyotiśśāstrasaṅgraha*,

Beg. *Saṅgrahe* paṭhyamānānām sādhanānam kriyocyate /

Mss. C. 2431-C, L. 1355-A, TM. 233-D.

Do.—C (Mal.), by the ⌐author himself. Mss. L. 1177, L. 1218, T. 233-C.

Saṅgrāmavijayodaya (nat. astrol.), Anon., (Ker. ?). Q by Rudra II (16th cent.) in his C on the *Horā*. Mss. Ker., Mad. Edn. *TSS* 123. Ref. Ul. II. 111-12; Ul. Sup. I. 215.

Sadratnamālā (kar.), by Śaṅkara Varmā, A.D. 1823, 6 chs., 300 gr.

Mss. 8322-B, C. 2136; Ad.; Mad. Edn. Serially in *Kavanodayam*, (Mal. Jl., Kozhikode), vol. 16 (1898). Ref. Raja, 165-66; Sen, p. 191; Ul. III, 499-501; Va. IV. 384-93.

Do.—C (Mal.), by the author himself. Mss. 8322-B, T. 1175. Edn: up to VI. 32, with the text above. Ref. Ul. III. 501; Ul. Sup. I. 636-37; Va. IV. 389-93.

Santānadīpikā (astrol.), Anon., by a pupil of Vāsudeva, 100 gr.

Beg. gurunātham namaskṛtya gaṇanātham praṇamya ca /
Vāsudevam gurum dhyātvā vakṣye *Santānadīpikām* //

Mss. 61C-A, 1416, 12810-B, C. 134-C, P. 968, PM. 4077-D, T. 286-A; Ad.; Mad. Edn. G. Kocchusankaran Vaidyan, S. T. Reddiar and Sons, Quilon, 2nd edn., M.E. 1105. Ref. Ul. III. 90; Ul. Sup. I. 464-65; Va. II. 501.

Santanadiprasnavicara (pra.) Skt.-Mal., Anon. **Ms.** 13494-B.

Samudravakya : See *Kujadipancagraha-mahavakya.*

Sampradayapradipika : Name of C by Govindasvamin on *Parasarahora.*

[*Samudrikalaksana* I (physiognomy), Anon.]

Do.—C I (Mal.), Anon.

> **Beg.** munpil ayussulakṣaṇam arika. ayussillenkil maṭṭulla lakṣaṇam nokkeṇṭa.

> **Ms.** P. 970-A.

Do.—C II (Mal.), Anon.

> **Beg.** munpil ayussine parikṣikkaṇam. pinne lakṣaṇatte collaṇam.

> **Ms.** P. 971-B.

Do.—C III (Mal.), Anon. **Mss.** 13204-A, C. 2079-B, L. 101 B, L. 216-B.

Do.—C IV (Mal.), unidentified ; possibly, one of the above.

> **Ref.** Va. III. 642-45.

Samudrikalaksana II (physiognomy), Skt.-Mal., Anon. **Mss.** 12721-C, 13389-B, 14311-B.

Samudrikalaksana III (physiognomy), Mal. prose, Anon. **Mss.** L. 206-B, T. 126-A-2.

Samudrikasastra (physiognomy), (Mal.), by Rāma Vāriyar of Kaikkulangara. **Ref.** See above, p. 80, § 81.

Samudrikasara, *Arudhaprasna* or *Lanchanasastra,* (omenology-pra.), by Śankara of Muktisthala. **Mss.** L. 101-A, C. 137-B (cata. *Arudhaprasna*) ; **Ad. Ref.** Ul. III. 86-87 ; Va. II. 723 (*Arudhaprasna*).

Do.—C I (Mal.), Anon., 150 gr.

> **Beg.** gaṇeśam ṣaṇmukham rudram umādevim sarasvatim /
> samvandya bhāṣayā vacmi *Lanchanam* tu yathāśrutam /
> > āyupraśne jivatām iti. tatrātha jivata iti. vṛddha-
> > darśanattinnu paññikkūṭṭam.

> **Ms.** C. 137-C.

Samudrikasara (contd.)

Do.—C II (Mal.), Anon.

Beg. aviṭe naṭe kaittalattilulla sthānannaḷeyum aviṭeyulla rohiṇi tuṭanniyulla rekhakaḷeyum ...

Ms. L. 101-A

Sārasaṅgraha : See also *Praśnasārasaṅgraha*.

Sārasaṅgraha (astrol.), Anon., in 9 chs.

Beg chāyā-jalayantrādyair avagamya dyugolanāḍikāḥ praśne /
sāvayavās tābhir ayam prāglagnavidhir nigadyate spaṣṭam //

Ms. C. 134-B.

[*Sāropadeśa* (astrol.), Anon.]

Do.—C (Mal.)

Beg. (of text) : Meṣādirāśiphalam—
piṅgākṣaḥ paittikaḥ krodhī sabhāmānyaḥ suvikramaḥ /
lubdhaḥ kṛtī ca capalo meṣarāśyām tu jāyate //

Ms Mad. D. 13914.

Siddhāntadarpaṇa (siddhānta), by Nīlakaṇṭha Somayāji, in 32 verses.

Mss. See Intro. to edn. Ed. and Tr. by K. V. Sarma, Adyar Library, Madras, 1955. Ref. Va. IV. 225.

Do.—C by the author himself. Ms. P. 975.

Siddhāntadarpaṇa-siddha-paryayādayaḥ (astron.), Anon., 17 verses.

Ms. 5867 (ff. 169-72). Ed. and Tr. by K. V. Sarma, with the edn. of *Siddhāntarpaṇa* above.

Siddhāntadarpaṇastha-paryaya-bhūdināni (astron.), Anon., 3 verses.

Mss. C. 2740 (fol. 98 b), C. 2314 (fol. 74). Ed. and Tr. by K. V. Sarma, in the edn. of *Siddhāntadarpaṇa*, above.

Sundararajapraśnottara (astron.), by Nīlakaṇṭha Somayāji.

Mss. Yet to be identified, but the work is mentioned by both Nīlakaṇṭha in his *Āryabhaṭīya-bhāṣya* (*TSS* 185, p. 149)

Sundararajapraśnottara (contd.)

> and Sundararāja in his C on the *Vākyakaraṇa* (Edn.
> T.S.K. Sastri and K.V. Sarma, K.S.R. Inst. Madras-4,
> 1962, p. 119).

Sundarī : Name of C by Udayadivākara on the *Laghubhāskarīya* of
.   Bhāskara I.

Subodhārthinī : Name of anon. C on *Horā*.

Subrahmaṇya I, a Nampūtiri of the Māttūr family, *c.* 1475-1535.

> —*Muhūrtapadavī* III (A.D. 1531).

Subrahmaṇya II, (1835-1903), a Tirumunpu of the Kunnattu family in
Payyannoor, in N. Malabar.

> —C *Bhāvaprakaśa* on the *Muhūrtadarśana* of Vidyāmādhava.

> **Ref.**   See above, p. 79, § 78 ; Ul. Sup. I. 540 ; V. I. 444.

Subrahmaṇya III (? alias Parameśvara, pupil of Śaṅkara)

> —C (IX), *Jātakacandrikā* or *Viśvārthadīpinī* on *Horā*
> (acc. to Ms. 5581).

Subrahmaṇya Śāstri, (1828-88), of the Nalleppaḷḷ village in Cochin.

> —*Agaṇitam* (kar.)

> **Ref.**   See above, pp. 78-79, § 77 ;   Ul. IV. 292 :   Ul. Sup. II.
> 122-23 ;   Va. IV. 607 ;   RNP IV. 481-82.

Sūkṣmacandrārkagaṇita :   See *Suddhacandrārkagaṇita.*

Sūkṣmacandrasphuṭādigaṇita (kar.), Mal. prose, Anon.

> **Ms.**   12686-C.

Sūryagrahaṇagaṇitam (ecl.), Mal. verse, Anon. 50 gr.

> **Ms.**   L. 765-D.

Sūyacandracchāyagaṇitam Bhāṣā (?), (kar.), Anon., Mal. verse.

> **Beg.**   pāṭum piṟappum eṇṇeṇṭum prakāram iha collinen /
>   iṣṭagrahayor arkan eṟunnāḷ udayattinu //
>   ādityād graham eṟum nāḷ eṇṇukāstamanattinu /
>   ādityane sphuṭikkeṇam appoḷ veṇṭum grahattinu //

> **Mss.**   PM. 4027, 4158-E.

Sūryacchāyādigaṇita I (?) (kar.), Mal., Anon.

Beg   sūryacchāya gaṇikkunna prakāram atha collinen /
talkālasāyanārkkannu caram meṣādi uttaram //

Mss.   5109-D (cata. *Sūryacchāyāgaṇita*, 70 gr.), L. 251-C (cata.
Candracchāyāgaṇita, 320 gr.), 5042-D, 10647-E, 13493-E,
all differing slightly from one another.

Sūryacchāyādigaṇita II (kar.), Mal. verse, Anon. Mss. 5042-D,
5109-D, 13493-E.

Sūryadeva Yajvan, (1191-c. 1250), of Nidhruvagotra

—C *Prakāśa* or *Prakāśikā* on *Āryabhaṭīya*

—C *Jātakālaṅkāra* on the *Jātakakarmapaddhati* of Śrīpati

—C on the *Mahābhāskarīya-bhāṣya* of Govindasvāmin

—C on the *Mahāyātra* of Varāhamihira

Ref.   See above, p. 48, § 14 ; Raja, 131-32 ; Sen, p. 214 ; Ul. II.
97-98 ; Ul. Sup. I. 219 ; Va. I. 390-92.

Sūryamadhyamādigaṇita (?) (kar.), Mal., Anon. Ms. 13394-I.

[*Sūryasiddhānta* (siddhānta)]

Do.—C I, *Vivaraṇa* by Parameśvara of Vaṭaśreṇi. Ms. 8358-J.

Do.—C II (Mal.), by Acyuta Piṣāraṭi (?)

Beg.   gurūṇām caraṇāmbhojaparāgaparamāṇavaḥ /
manomukuram asmākam punīyur anuvāsaram //

avite *Sūryasiddhāntam*ākunna ... gaṇitatte camappān
tutaṅṅunna ācāryan ...

Mss.   3636-C, 8358-A, T. 251. Authorship. Suggested on
the basis of the characteristic *maṅgala-śloka* of Acyuta
Piṣāraṭi, which occurs in his *Uparāgakriyākrama-vyākhyā*,
Karaṇottama, *Jātakabharaṇa* and *Veṇvāroha-vyākhyā*, and
also on the similarity of the beg. of the present C with the
beg. of Acyuta's *Veṇvāroha-vyākhyā*.

Sūryasiddhānta-saṅgraha (siddhānta), (Ker. ?). Ms. Cranganore
Palace List, 4.

Sūryoparāgakriyā (ecl.), Mal., Anon.

Beg. nayī jīvas surāgiṇo narastuṅga-śarāsanaḥ /

Ms. 931-C (inc , 100 gr.)

[*Skandaśarīraka* (nat. astrol.)]

Do.—C (Mal.), Anon. **Ms.** P. 979 (interspersed with Skt.).

Sthānaphalādi (astrol.), Mal., Anon. **Ms.** 8269-B.

Sphuṭanirṇaya (astron.), by Acyuta Piṣāraṭi, in 6 chs., devoted respectively, to *Saṅkhyakathana, Madhyamānayana, Mandasphuṭa- nayana, Bhagolasphuṭanayana, Bhūgolasphuṭānayana* and *Bhū- pṛṣṭhasphuṭanayana.*

Mss. C. 809-C, C. 964-B, C. 1945-B ; Mad. R. 3799 (b) ; Kanippayyoor Mana, Kunnamkulam ; Eḷamprakkoṭṭu Mana , Eravoor ; M.S. Srinivasa Sastri, Palghat.

Ref. Sen, p. 202 (where it is noticed as anon. and the subjects of its Chs. IV, V and VI given, wrongly, under the common heading *Bhūgo[la]sphuṭanayana*) ; Va. IV.225. **Cr. Edn.** by K.V. Sarma.

Do.—C, *Vivṛti,* by the author himself. **Mss.** C. 697-C, C. 809-C, C. 964-B, C. 1945-B ; Mad. R. 3792 (b) ; M.S. Srinivasa Sastri. **Ref.** Sen, p. 202. **Cr. Edn.** by K.V. Sarma.

Sphuṭanirṇaya-nirṇīta-paryayādayaḥ (astron.), Anon., 14 verses.

Beg. abhivandya gurum bhaktyā kalpakālaprakīrtitāḥ / *Sphuṭanirṇaya-nirṇīta* varṇyante *paryayādayaḥ* ||

Ms. With K.V. Sarma. **Cr. Edn.** K.V. Sarma.

Sphuṭanirṇaya-bhagaṇāḥ : See *Tantrasaṅgrahāt Sphuṭanirṇaya- bhagaṇāḥ.* **Cr. Edn.** by K.V. Sarma.

Haridatta, (c. 650-700), promulgator, in A. D. 683, of the Parahita system of astronomy in Kerala.

    —*Grahacāranibandhana*

    —*Mahāmārganibandhana*

Ref. See above, pp. 7-9 ; 43-44, § 5 ; K.V. Sarma, Intro. to the edn. of *Grahacāranibandhana,* Madras, 1954 ; Raja, 123-26.

[*Horā* (jā.), by Varāhamihira]

Do.—C I, by Kṛṣṇa. **Ms.** Public Library, Trivandrum, 35.

Hora (contd.)

Do.—C II, in verse, by a disciple of Kṛṣṇa.

Beg. prāyeṇa mandabuddhinām manuṣyāṇām kalau yuge /

laghunaiva prakāreṇa *Hora*yam upadiśyate ||

āyur hi trividham loke pūrṇa-madhyālpanāmabhiḥ /

End. *Kṛṣṇācāryasya Śiṣyeṇa Horeyam* upapādita /

Kṛṣṇācāryaprasādena prasādāc ca vivasvataḥ ||

Ms. IO 6381-D.

Do.—C III, *Daśādhyāyī*, by Govinda Bhaṭṭatiri of Talakkuḷam, 3800 gr.
Mss. 957, C. 2141-A ; Mad. D. 14064. Ed. Bombay, Saṁ.
1969 (A.D. 1912) ; Palghat, (1905). Ref. Raja, 132-33 ;
Ul. I. 167-79, II. 110 ; Va. I. 353-59.

Do.—C IV, *Prakāśika* or *Viṣamākṣaravivṛti* by Nityaprakāśa Yati.
Mss. C. 136, C. 227, P. 997, T. 90 ; Ad.

Do.—C V, *Subodhārthinī*, Anon., (Ker. ?)

Beg. ātmāyate vāsarapo 'khilānām

aṅgāyate janmavivarjitānām /

dīpāyate yo jagatām abhīṣṭam

dadhātu naḥ so 'nyatarānapekṣaḥ (1) ; ...

yā *Horā* racita ... (2) ; athācāryeṇāsya śāstrasyāvighna-
parisamāptyartham ...

Mss. C. 1244 ; Ad. ; Mad.

Do.—C VI, *Vivaraṇa* or *Naukā* by Rudra, A.D. 1527, 6000 gr.

Mss. 14267-B, C. 2237 ; Ad. ; Mad. ; Tir. Edn. *TSS* 91,
(Trivandrum, 1926 ; 2nd edn., 1958). Ref. Ul. II. 114-17 ;
Va. I. 531-34.

Do.—C VII, *Pāṭhyam*, Anon. Ms. P. 892 (inc., 3000 gr.)

Do.—C VIII, *Pārameśvarī* or *Horabhiprāyanirṇaya*, by Parameśvaraı

Beg. arkendvārajñavāgīśaśukramandatamodvijāḥ /

praṇamya kriyate spaṣṭo *Horabhiprāyanirṇayaḥ* ||

mūrtitve iti. ravir no vācam dadātu ityarthaḥ.

Mss. C. 135-A, C. 2110, T. 79 ; Ad. Edn. *TSS*, Trivandrum,
1963.

Do.—C IX, *Jātakacandrika* or *Viśvārthadīpinī*, by Parameśvara, pupil
of Śaṅkara.

Horā, C IX (contd.)

Beg. yasyaikadeśam āśritya modate nikhilam jagat /

tasmai namo 'stu bhagavate parāya paramātmane !!

namāmi śirasā devam *Śaṅkaram gurum* ātmanaḥ /

yasya prasādenājñānam akhilam me nirākṛtam //

*Horātantra*bdhitārāya śāstrapoto nirūpitaḥ /

*Varāhmihire*ṇāsya vyākhyānam kriyate mayā //

mūrtitve (text) ...

Mss. 3634, 5851, 10535, C. 1366-B, L. 552-B, T. 732. **Note.**
Ms. 5851 names the au. also as 'Subrahmaṇya.'   **Ref.** Va.
III. 394.

Do.—C X, Anon., by a pupil of Pūrṇaprajña or Pūrṇaprabodha.

Beg. aviratam atitiṣṭhan maṇḍalācaṇḍabhānor-

niravadhinijatejassyandasandīpitāśaḥ / ... (1)

nikhilajagadupāsyo nityaśo yas trisandhyam

diśatu mama rameśo jyotiṣām eṣa bodham //

*Pūrṇaprajñā*dikāneka-sadguṇā madgurūttamāḥ /

sādhayeyur iman santo māmakīnamanoratham //

... asmin *Horāśastre* mūrtitva ityādinā prārambha-
samuciteṣṭadevatānamaskāraślokena ...

Ms. CM. 6-C (cata. *Ārūḍharāśikathanam*).

Do.—C XI, *Bṛhajjātaka-prathamaślokavyākhyā,* Anon.

Ms. TM. 144-C-1 (45 gr.).

Do.—C XII (Old Mal.), *Prakāśikā* by Nityaprakāśa Yati.

Beg. mūrtitve ... enpatu śaśabhṛttinuṭe mūrttitvam ākkapeṭṭu,
apunarjanmākkaḷukku vartmāvāyi, yajvākkaḷukku kratuvu-
māyi, jyotiṣaṁkaḷukkellām svāmiyumāy, ...

Ms. P. 995. Note. This C is diff. from this au.'s Skt. C *Prakāśikā*
on *Horā.*

Do.—C XIII (Mal.), *Horāvyakhyānam Tamizhkkuttu,* Anon.

Beg. Horāśāstratte camappān tuṭaṅṅunna ācāryan iṣṭadevatā-
vandanam ceyyunnu i ślokam koṇṭu.

Mss. C. 590, C. 2524, T, 133-B, F.

Hora (contd.)

Do.—C XIV (Mal.), Anon.

Beg. natvā gaṇapatim devīm vācam ācāryakovidān /
Varāhamihirācāryam śrīsūryādinavagrahān //

gurum gurūttamam cāpi tathā sahrdayān api /
pāramparyagatam śāstram *Horārtham* prakaṭīyate //

mūrtitve ... itin poruḷ—sa raviḥ vācam daḍātu. aṅṅane
ellāmirikkunna ravi namukkāyikkoṇṭu vākkine taruvonāka.

Ms. T. 133-ᘒ.

Do.—C XV (Skt. and Mal.), Anon.

Beg. bhūyobhiḥ paṭubhiḥ paṭudhiyām horāphalajñaptaye
śabdanyāyasamanviteṣu bahuśaḥ śāstreṣu dṛṣṭeṣv api /
horātantramahārṇavapratāraṇe bhagnodyamānām aham
svalpam vṛttavicitram arthabaulam śāstraplavam prārabhe //

Ms. PM. 4385.

Do.—C XVI (Mal.), Anon.

Beg. mūrtitveti. sa raviḥ naḥ vācam dadātu. ā ravi namukku
vākkine taruvūtāka. śaśabbṛiaḥ mūrtitve parikalpitaḥ=
śaśabhṛttiṇṭe mūrttitvattiṅkal parikalpitanāyirunnoruttan.
śaśabhṛttiṇṭe=candraṇṭe. mūrttitvattiṅkal=vṛttākāramāyiri-
kkiṇṭa dehattiṅkal. paritaḥ=cuṭṭākāreṇa kalpitamāyiri-
kkunna ...

Ms. PM. 4155-A.

Do.—C XVII (Mal.), *Horāvyakhyānam*, Anon.

Beg. sa raviḥ naḥ vācam dadātu. ā ravi namukku vākkine taru-
vūtāka. sarvaprakāśanāyi jñānasvarūpanāyiripporuttan...

Col. (C. 2226-A) : its horāśāstre Bṛhajjālaka-*Viṣamākṣaravivṛtau*
Prakaśikāyām Utpalāyām Drekkāṇādhyāyaḥ pañcaviṁśaḥ.

Mss. 6551, 12974-B, L. 521.

Do.—C XVIII (Mal.), *Horāvyākhyānam*, Anon. **Ms.** 872-A.

Do.—C XIX (Mal.), Anon.

Beg. ā ravi praśna-jātaka-muhūrttādikaḷil satyayāyirikkunna
vākkinettarutāka. sarvaprakāśanāyi jñānasvarūpanāyiri-
kkiṇṭoruttan ādityan. candraṇṭe śarīramakakkalpiccirunno-
ruttan.

Ms. P. 999. *Note.* Related to C XVII, above.

Hora (contd.)

Do.—C XX (Mal.), Anon.

Beg. (Ch. 21) lagnattiṅkal ninnu putrakalatrabhamkal śubhapati-prāptaṅṅalāyirikkumpol ...

Ms. P. 996.

Do.—C XXI (Mal.), *Horāphalaratnāvali*, apocryphally attributed to Kaṇṇaśśa Paṇikkar.

Beg. Kaṇṇaśśan ennuḷḷa Paṇikkaraccan
khaṇḍiccu maṭṭuḷḷa mataṅṅalellām /
nirṇīta-*Horāphalaratnasāram*
varṇiccu collunniha śiṣyanoṭāy //

       iviṭe kavi uṇṭākkān bhāviccirikkunna granthatte ...

Edn. Sri Rama Vilasam Press, Quilon, M.E. 1102.   **Ref.** Ul. I. 350-51 ; Ul. Sup. I. 129.

Do.—C XXII (Mal. verse), by a pupil of Rāma.   Men. in the beg. of the au.'s *Laghuhorāvivaraṇam* ; cf. :

       rānaśāstraṅṅal kaṇṭiṭṭu rānāvṛttaṅṅalāl punaḥ /
       '*Horāśāstram* camaccittaṅṅāryāvṛttaṅṅalāl punaḥ //
       Laghuhora camaykkunnen ...

Horāphalaratnāvali by Kaṇṇaśśa Paṇikkar :   See *Hora*, C XXI.

Horābhiprāyanirṇaya by Parameśvara : Name of C VIII on *Hora*.

Horāsāra (jā.), Anon.

Beg. pāśaṅkuśa-svarada-cūtaphalam dadhānam ... (1) ;
jayati jagadekahetur viśvātmā ... (2) ;
nimiṣādivatsarāntam ... (3)

Mss. C. 226, C. 772, C. 2112-A, P. 1001 ;   Ad.

Horāsāroccaya (jā.), by Acyuta Piṣāraṭi, in 7 chs.   **Mss.** 8327-A, 8327-B (with C).   **Ref.** Ul. II. 324.

Do.—C (Mal.), *Horātantram Paribhāṣa*, Anon.   **Ms.** 8327-B.

Ref. Chirakkal T. Balakrishnan Nair, 'Horātantram Paribhāṣā', *Sahitya Parishat Traimasikam*, (Mal., Ernakulam), 5 (M.E. 1112) 417-20 and Ul. II. 651, where it is attributed to Acyuta Piṣāraṭi himself. For a refutation of this view, see K.V. Sarma, Intro. to his edn. of *Raśigolasphuṭānīti*, p. 7.

X   **An Unidentified Astronomer.** About a dozen metrical tracts on different astronomical topics, couched in simple Malayalam verse, have been recorded, which, from their very similar narrative style and identical expressions, seem to be from the same pen, possibly, even sections of an extensive work which used to be studied individually and, so, are now generally found distributed in different mansucripts. Their author, however, prefers to remain anonymous. These works are as follows :

Similar expression in the initial verse

—*Gāṇitam-Bhāṣā* II (Mal.)	prakāram	atha	collinen
—*Pañcabodha* IX ,,	Do.	Do.	Do.
—*Lātavaidhṛtādiganita* ,,	Do.	Do.	Do.
—*Sūryacchāyādiganita* I ,,	Do.	Do.	Do.
—*Candragaṇita* ,,	gaṇippāṇ	iha	Do.
—*Candrasphuṭādiganita* II ,,	Do.	Do.	Do.
—*Sūryacandracchāyāgaṇita* ,,	Do.	Do.	Do.
—*Candrasphuṭādiganita* ,,	Do.	kriya	Do.
—*Śuddhacandārkagaṇita* ,,	Do.	Do.	Do.
—*Grahaṇaganita* X ,,	collunnuṇṭu	curukki	ñān
—*Chāyāgrahaṇaganita* II ,,	Do.	Do.	Do.
—C on *Vyatīpātavaidhṛta* ,,	Do.	Do.	Do.

ADDITIONS

Page 86 : **Acyuta II** : Acyuta Piṣāraṭi

        Add : —C on *Sūryasiddhānta*

,, 101 : *Keralācārya.* See also below in Ch. VI.

,, 118 : **Citrabhānu-Śiṣya**

        Add : —*Grahaṇāṣṭaka* III (?)

           —*Praśnaprakāśika* I (?)

           —*Praśnabhāṣā* I (?)

           —C IV on *Pañcabodha* II (?)

           —C V on *Muhūrtapadavī* II (?)

,, 142 : *Praśnaprakāśika* I

        Add : By Citrabhānu-śiṣya (?). Authorship. Suggested on the basis of the characteristic *maṅgala-śloka.*

CHAPTER VI

A BIBLIOGRAPHY OF KERALA-BASED JYOTIṢA LITERATURE

There exist, in regions outside Kerala, in Sanskrit and in other Indian languages, a considerable number of astrological texts which proclaim themselves as Kerala Jyotiṣa and, as such, might, in a way, be called 'Kerala-based jyotiṣa texts'. The possible origin, nature and major trends of these texts have been discussed briefly elsewhere in this book (see pp. 38-40). These works can be identified by one or more of such indications as : (1) the definite mention of their non-Keralite authorship ; (2) the addition of the expression 'Kerala' to their titles, apparently intended to distinguish them from other regional or all-India texts of the same or similar titles ; (3) their high popularity ouside Kerala which is matched only by their being practically unheard of in Kerala, the reason for which is obviously that, in a conservative society, one would scarcely go in for a low-rate alien imitation or improvisation when the full original is with oneself. Most of these works are anoymous or ascribed to apocryphal authors. Some claim to be parts of larger works. It is but natural that, while manuscripts of these works occur in good numbers outside Kerala, indicating their popularity in trans-Kerala regions, in Kerala itself, their manuscripts are well-nigh absent. It is a moot point as to what extent these texts are indebted to Kerala Jyotiṣa in the matter of the their tradition, teachings or inspiration. In some cases, it might be regular borrowal, in others restricted to their nature and contents and in still others only to the ideas. In certain cases, it is even possible that Kerala has lent nothing more than its name ! The lack of definitive authorship and the amorphous nature of contents of some of these works, naturally, make their identification difficult. This is especially so, in the case of works which appear under different titles and in varied extent, a fact which is reflected in the following *Bibliography*, as well. Certain methods to ascertain the indebtedness of individual texts to Kerala Jyotiṣa and to pursue this interesting study have been suggested above (see p. 41).

In the following pages, an attempt has been made to document information about 'Kerala-based' Jyotiṣa works, in Sanskrit, from various sources, and present the same with suitable annotations and references about the availablity of manuscripts and editions thereof

but without any serious effort at the correlation of allied texts. The nature of the different texts is indicated by adding, after their titles, their subjects in abbreviation : 'kar.' for *Karaṇa*, 'jā.' for *Jataka*, 'pra.' for *Praśna*, 'muh.' *Muhūrta*, 'astrol.' for General Astrology, 'nat. astrol.' for Natural Astrology, etc. The general abbreviations employed in the *Bibliography of Kerala Jyotiṣa literature*, above, have also been made use of, as necessary.

In the case of texts whose manuscripts, as available in the different manuscripts repositories, have been noticed in the *Catalogus Catalogorum* (CC) of Aufrecht or the *New Catalogus Catalagorum* (NCC), I-VI, of the Madras University, the CC or NCC references are given. And, in the case of texts which have not been noticed in the CC or the NCC, or which exhibit some peculiarity or other, they are referred directly to the relevant Manuscripts Catalogues or other sources, using The undermentioned additional abbreviations :

Lucknow, Skt. Parishad
: *A catal. of Mss. in the Akhila Bharatiya Skt. Parishad, Lucknow,* compiled by Daulat Ram Juyal, Lucknow, Vos. I-II, 1963, 1969. (Ref. by vol. and pp.)

Mysore
: *Cata. of Skt. Mss. in the Govt. Lib., Mysore,* and its Supplemental Cata., in 4 Pts., Mysore, 1922-1955 (Ref. by vol. and pp.)

Nepal Vir.
: *Nepāla- Rajakīya-Vīraputakālayastha- Hastalikhita-Samasta-pustakānām Saṅkṣipta-sūcīptram,* Ed. Buddhi Sagara, Kathmandu, Sam. 2020. (Ref. by pp. and nos.)

Raj. Jaina
: *Rājasthān kī Jaina Śāstra Bhandārom kī Granthasūcī,* Ed. by Kastur Chand Kasaliwal etc. Jaipur, Vols. I-IV, 1949-1962. (Ref. by vol. and pp.)

Raj. Jodh.
: *A cata. of Skt. and Pkt. Mss. in the Rajasthan Or. Res. Inst. (Jodhpur Colection),* ed. by Muni Jinavijayaji, Pts. I-III B, Jodhpur, 1963-68. (Ref. by vol. and pp.)

Varanasi
: *A des. cata. of Skt. Mss. acquired aud deposited in the Skt. Univ. Lib. (Sarasvati Bhavana), Varanasi, during the years 1791-1950,* vols. I-XII, Varanasi, 1953-65. (Ref. by vol. and pp.)

V.V.R.I.
: *Catalogue of V. V. R. I. Manuscript Collection,* in two Parts. ep. by Vishva Bandhu, Hoshiarpur, 1959. (Ref. by pt. and pp.)

Akṣarakeralī or *Akṣarakevalī* (pra.). Mss. See NCC I (rev.), 11.

Akṣaracintāmaṇi (pra.) from *Keralamata* ascribed to Śiva. Ib., 12.

Akṣaracūḍāmaṇi (pra.) related to *Keralapraśna* V attributed to Keralācārya. Ib.

Appāsūri, *alis* Nṛhari or Nṛsimha
    —C, *Śāradāgama*, on *Uḍudayapradīpa*

Avajadapraśna or *Keralipraśna*, from the *Rudrayāmala*, Ib., 412.

Uḍudayapradīpa (jā.), described in some mss. as *Keralīgrantha* and *Keralīracita*. Mss. NCC II. 289-90. Ascribed to Keralācārya in Ms. Ker. 1521. Edn. with Tr., Royal Victoria Press, Madras, 2nd edn., 1900. For other edns., see NCC II 289.

Do—C I. Anon., Ib. 290.

Do.—C II, *Uddyota* by Bhairavadatta, son of Harirāma. Ib.
    Edn. Bombay, 1875 ; with Hindi C, Banaras, 1868.

Do.—C III, *Tattvadīpikā* by Jīvanātha Jhā, son of Śambhunātha. Ib.

Do.—C IV, *Śāradagama* by Appāsūri *alias* Nṛhari or Nṛsimha. Ib.

Do.—C V, *Snehakūpika* by Bālakṛṣṇa, son of Jyotiḥsvarūpa. Ib.

Do.—C VI, by Cola. Ib.

Do.—C VII, by Paramasukha. Ib.

Do.—C VIII, by Mayūreśvaropādhyāya. Ib.

Uḍupakerala (jā.), attributed to Prajāpati. Ib.

Kerala° : See also *Keralī°*, *Keraliya°*.

Kerala or *Keralī* (astrol.) Mss. NCC V. 43.

Keralagranthodāraharaṇa (astrol.), by Mūladeva, possibly a C on his *Keralapraśna*. Ib.

Keralacandrikā (jā.) Ib. (*Dvādaśabhāva*). See also *Keraladvādaśa-bhāva*.

Keralacintāmaṇi (astrol.)   Ib.

Keralacūḍāmaṇi (pra.)   See also *Keralapraśna* or *Divyacdūḍāmaṇi* and *Cūḍāmaṇikeralī*.

Keralajātaka (jā.)   NCC V. 43.   See also *Keralīyam Jatakam.*

Keralajātakananda or *Keralarahasya* : See *Keralarahasya.*

Keralajñāna or *Keralīyajñāna* (pra.)   NCC V. 43.   Some as *Keralapraśna.*

Keralajyotiṣa or °*jyautiṣa* (astrol.)   Ib.

Keralatattva (astrol.)   Ib.

Keraladīpikā I (astrol.)   Men. in *Keralacandrikā,* Mad. D. 14026.

Keraladīpikā II (astrol.), by Krahā...śa, son of Cannayajvan.   **Ms.** NCC V.43.

Keralanāḍī (astrol.)   Ib.

Keraladvādaśabhāvaphala I (jā.), in verse.   Ib.

Keraladvadaśabhāvaphala II (jā.), in prose.   Ib.

Keralapañcapakṣī (prognostication), from *Svaravicāra.*   Ib.

Keralapāśāvalī (prognostication), ascribed to Garga.   Ib.   See also *Paśakakevalī.*

Keralapradīpa (astrol.).   Ib.   Possibly, *Jañānapradipa* or *Keralabṛndāvana* of Padmanābha.

Keralapraśna(*grantha*) I (pra.) Mss. NCC V.44 ; Varanasi, IX. 304.

Keralapraśna(*grantha*) II (pra.), ascribed to Garga.   Ib.

Keralapraśna III (pra.)   Invokes Kūṣmāṇḍi; the last verse of the work describes the work as the *Pāśakakeralī* of Garga.   Ib.

Keralapraśna IV (pra.), Prognostication with arecanuts.   Ib.

Keralapraśna V or *Divyacūḍāmaṇi,* ascribed to Keralācārya.   Related to *Akṣaracūḍāmāṇi* and *Cūḍāmaṇisāra.* Ib.   **Edn.** in Telugu script with Telugu gloss, Vavilla Press, Madras, 1944 ; Banaras, Sam. 1731.   See also *Cūḍāmaṇikerali.*

Keralapraśna VI or *Keralapraśnaprakaraṇa* or *Keralīyajñāna,* (pra. based on letters.) Ib.

Keralapraśna VII (pra.), in 67 verses. Ib. Edn. with Hindi. Tr., Lakshmipur, Bombay, 1913.

Keralapraśnagrantha (pra.), by Mūladeva. Mss. NCC V.44.

Do.—C (?) *Keralagranthodaharaṇa,* by the author himself. Ib. 43.

Keralapraśnāḥ (pra.) Mss. Varanasi, IX. 288, 298.

Keralabayalis : Name of *Uḍudāyapradīpa* attributed to Keralācārya.

Keralabṛndāvana or *Jñānapradīpa* (astrol.), by Padmanābha. Mss. NCC V. 44.

Keralabhāgya (astrol.)   Ib.

Do.—C. Ib.

Keralabhāṣya (astrol.), Ib. On *Keralavacanāni* (?)

Keralamata (astrol.), ascribed to Śiva : See *Akṣaracintāmaṇi.*

Keralamatapraśnasaṅgraha (pra.) by Mihirabhaṭṭa. Ms. VVRI I. 82.

Keralayātrā (nat. astrol.) Ms. NCC V. 45.

Keralayogāvalī (astrol.) Ib.

Keralaratnamañjarī (astrol.) by Viśvanātha Bhaṭṭa, Ib.

Keralaratnākara (astrol.) Ib.

Keralarahasya or *Keralajātakānanda* (astrol.), by Śukrācārya. Ib.

Keralarājayogasāra (astrol.) Ib

Keralavacanāni (astrol.) Ib.

Do.—C, *Keralabhāṣya,* by Ḍhuṇḍhirāja. Ib.

Keralaśāstra I (astrol.), Ib., 47 ; Varanasi, IX. 314. See also *Keralīśāstra.*

Keralaśāstra II, Sn. *Gargasaṁhitā* (pra.) NCC V.45.

Do.—C, *Gargamanoramā.* Ib.

Keralaśāstrasūtra (astrol.) attributed in one of its mss. to a demoness named Nikaṣā.

Do.—C. Ib.

Keralaślokasūtra (astrol.)   Ib.

Keralasāra (astrol.)   **Ms.** Varanasi, IX. 286.

Keralasiddhānta (pra.), couched in the form of a dialogue between the divine couple, Pārvatī and Parameśvara,   **Ref.** Ul. Sup. I. 228.

Keralasūtra I (astrol.)   **Ms.** NCC V.47.

Keralasūtra II (astrol.), ascribed to Marīci, Ib ;   Varanasi, IX. 296.

Keralasūtra III (jā.), by Śrī (?).   **Ms.** Mad. T. 1981 (d).

Tr. in *Missing links of Hindu astrology*, No. 11, Bombay, 1963.

Keralahora (jā.).   **Ref.** Ul. Sup. I. 229.

Do—C by Sarvartu Paṇḍita, written at the instance of Gopāla, at Vijayanagar.   **Ms.** NCC V. 47.

Keralācarya. Despite the Kerala tradition that he was the minister of a Kerala King, it is not unlikely that he is an apocryphal or non-Kerala author. See above, pp. 46-47.

> —*Uḍudāyapradīpa*
> —*Keralapraśna* V or *Divyacūḍāmaṇi*
> —*Mātrācūḍāmaṇi*
> —See also above, pp. 101-2.

Keraliprasna or *Avajadapaśna*, from the *Rudrayāmala*. NCC V. 48.

Keralī° : See also Kerala°.

Keralī I (astrol.) or *Kerala*.   **Ms.** NCC V.43.

Keralī II (nat. astrol.)   Ib. 48.

Keralī III (pra.) by Rāvaṇa.   Ib.

Keralī IV (pra.), or *Pāśakeralī*, prediction based on throwing the dice, ascribed to Garga. Ib.   See also *Pāśakakeralī*.

Keralīgrantha (jā.), or *Uḍudayapradīpa* or *Jātakacandrikā*, by Veṅkaṭeśa. Ib.

Keralīcūḍāmaṇi (pra.)   Ib.   See also *Keralapraśna* or *Divyacūḍāmaṇi*.

Keralī(ya)jātaka (jā.)   Ib.   See also *Keralajātaka* and *Keralīyam Jātakam*.

Keralī(ya)jñāna (pra.) Ib. See also *Keralajñāna*.

Keralidaśaprakāra (jā.) Ib.

Keralīpraśna (pra.) Mss. Varanasi IX. 294, 302. See also *Keralapraśna*.

Keralīpraśnabhāṣā (pra.) Ms. Nepal Vir, 28.

Keralīpraśna(vicāra), (pra.) Ib. ; Nepal Vir, 28.

Keralīpraśnasaṅgraha (pra.) Mss. NCC V.48.

Keralīpraśnasāra (pra.) Ib.

Keralīya (jā.) Ms. Mad. T. 2233 (g) (*Jīvakādhyāya*).

Keralīyajātakasaṅgraha (jā.) Ms. Mysore, I. 332.

Keralīya(jyotiṣa) (jā.) Ms. Mad. T. 1623.

Keralīyajñāna (pra.) Mss. Tanjore, D. 11685, 24028. See also *Keralajñāna*.

Keralīyanakṣatradaśaphala (jā.). Ms. NCC V.48.

Keralīyapraśna (pra.) Mss. Ib. ; Raj. Jodhpur, III-B. 508.

Keralīyapraśnaratna (pra.), by Nandarāma Paṇḍita.
 Edn. with Hindi C, Lakshmi Venkatesvara Press, Bombay : Kalyan, 1923-24.

Keralīyapraśnaratnākara (pra.) Men. Ul Sup. I. 228.

Keralīyabhāṣāsāra (astrol.) Ms. NCC V. 49.

Keralīyasūtra (jā.) Ms. Mad. 1981 (d), on *dvādaśabhāva.*

Keralīyam Jātakam (jā.) Ms. Mysore, I. 332.
 See also *Keralajātaka.*

Do.—C. Ms. Mysore, I. 332.

Keralīyam jātakam (Saṅgraha) (jā.), Ms. Mysore, I. 332.

Keralīśakuna (omenology), ascribed to Vyāsa. Ms. NCC V.49.

Keralīśakunāvalī (omenology), by Bhañjana Miśra. Ib.

Keralīśastra (astrol.) Ms. Nepal Vir. 28. See also *Keralaśāstra,*

Do.—C (Newari). Ms. Nepal Vir, 28.

Keralīsammatākoṣṭhiprakaraṇa (astrol.)   **Ms.** NCC V.49.

Keralīsārasaṅgraha (astrol.). Ib.

Krahā ... śa, son of Canna Yajvan.

    —*Keraladīpikā*

Garga

    —*Keralapāśāvalī*

    —*Keralapraśnagrantha*

    —*Keralī* or *Paśakeralī*, all related.

Cūdmaṇikeralī (pra.),   **Ms.** IO 3126.   See also *Keralapraśna* V or *Divyacūḍāmaṇi*.

Cūdmanisāra (pra), by Lakṣmaṇa, a résumé of the *Divyacūḍāmaṇi* or *Keralapraśna* V of Keralācārya. **Ms.** CC I. 189.

Cola

    —C (VI) on *Uḍudāyapradīpa*.

Jātakaratnāvali (*Keralīyā*), (jā.)   **Ms.** Raj. Jodh. II-B. 320.

Jīvanātha Jhā, son of Harirāma

    —C *Tattvadīpikā* on *Uḍudāyapradīpa*

Jñānapradīpa (°*ka* °*pikā*) : Same as *Keralabṛndāvana* by Padmanābha.

Dhuṇḍhirāja

    —*Keralabhāṣya* on *Keralavacanāni*

Dvādaśbhāva(phalā) : See *Keralacandrikā* and *Keraladvādaśabhāvaphala*.

Nandarāma Paṇḍita

    —*Keralīya-praśnaratna*

Nikaṣā, a demoness

    —*Keralaśāstrasūtra*

Nṛhari or **Nṛsimha,** alias **Appāsūri**

    —C, *Śaradāgama*, on *Uḍudāyapradīpa*

Padmanābha

    —*Keralabṛndāvana* or *Jñānadīpa* (°*paka*, °*pik a*)

    —*Keralapradīpa* (possibly same as the above work)

Paramasukha

  — C on *Uḍudayapradīpa*

Parahita (kar.), apparently by a Tamil astronomer, based on the Kerala Parahita school. Epoch : Kali-day 16,83,312 (A.D. 1507). Couched in corrupt Sanskrit.

Beg. hariharavidhikhecarān praṇatvā

   kalidivasāt 'priyabālajātako'nāt /

   bhavati hi varabhaumavārapūrvam

   parahitakhaṇḍam iti bruvanti santaḥ //

    guṇkārah kulam bhānoḥ *etc.*

Ms. Tanjore D. 11719 (70 gr.)

Paśakakeralī : See *Pāśkakevalī.*

Paśakakevalī (prognostication by dice throw), sometimes spelt as *Paśakakeralī, Pāśakevalī* or *Paśakevalī*, attributed to Garga.

Mss. CC I. 336 ; Lucknow, Skt. Parishad, I. 232.

Paśakevalī I or *Jñānabhāskara* (nat. astrol.)   **Ms.** Raj. Jaina, IV.286.

Paśakevalī II or *Keralapraśna* (pra.), by Garga. **Mss.** Raj. Jaina, II. 272 ; IV. 286 ; Raj. Jodh. II-B. 330 ; Tanjore D. 11496.

Do.—C *Tīkā.* **Mss.** Raj. Jodh., II-B. 330.

Prajāpati

  —*Uḍupakerala*

Praśnakeralī (pra.), by Bhojarāja. **Ms.** Varanasi, IX. 50.

Praśnabhārgava-kerala (pra.). **Ms.** CC I. 358.

Praśnavidyā (pra.), from *Keralīya.* **Ms.** NCC V. 49.

Bālakṛṣṇa, son of Jyotiḥsvarūpa

  —C, *Snehakūpika*, on *Uḍudayapradīpa.*

Bharagva-pañcangam (astrol.), by Vararuci IV.

> End :   ity evam *Bhārgavam nāma Pañcāngam Bhārgavoditam* |
> viditvā manujo yas tu kurute kāryam anvaham //

> Col.   iti *Vararuci-viracitam Bhārgavapranītam Pañcāngam* samā-
> ptam.

> Ms.   Mad. D. 14055.

Bhañjana Miśra

> —*Keralīśakunāvalī*

Bhairavadatta

> —C, *Uddyota*, on *Ududāyapradīpa*

Bhojarāja

> —*Praśnakeralī*

Mayūreśvaropādhyāya

> — C on *Ududāyapradīpa*

Marīci

> —*Keralasūtra*

Matracūdamani (jā. ?), by Keralācārya. Ms. Imperial Museum
(now in the Asiatic Soc., Calcutta), 10737.

Mihira Bhatta

> —*Keralamata-praśnasangraha*

Mūladeva

> —*Keralapraśnagrantha*
> —*Keralagranthodāharana*, possibly C on above.

Rāvana

> —*Keralī* (pra.)

Laksmana

> —*Cūdamanisāra*

Vararuci III, Tamil astronomer of Kanchipuram who adapted the
Parahita system of Kerala astronomy in the Tamil region.
c. 1300 A.D.

> —*Vakyakarana* or *Vakyapañcadhyayī*

Vararuci III (contd.)

Ref. T. S. K. Sastri and K. V. Sarma, Intro. to *Vakyakarana*, (Madras, 1962), pp. vi-ix.

Vararuci IV

—*Bhārgavapañcāṅga*

Vakyakarana I or *Vākyapañcadhyāyī* (kar.), by Vararuci III. Basic manual of the Vākyapañcāṅga of the Tamil country. In five chapters devoted, respectively, to *Ravicandrarāhusphuṭa*, *Tarāgrahasphuṭa*, *Triprasna*, *Grahaṇa* and *Udayāsta-mahāpātāḥ*.

Mss. See Intro. to edn. Cr. Edn. with detailed Intro., Summary of contents and Appendices, by T. S. Kuppanna Sastri and K.V. Sarma, K.S.R. Institute., Madras-4, 1962.

Do.—C I, *Laghudīpikā* or *Laghuprakāsika* by Sundararāja.

Mss. See Intro. to edn. Cr. Edn. by T. S. K. Sastri and K.V. Sarma, with the edn. of the text, above.

Do.—C II, *Sundararājīya* or *Vasanāprakāsikā* by Sundararāja, being more extensive than C I above.

Men. by the au. himself in his C I, edn., pp. 3, 21, 24, 49, 90, 107; See also the intro. to his C I :

śrī-Nilakaṇṭhāṅghriniviṣṭacetāḥ

śrī-Somadevānujighṛkṣayaiva /

vicitravākyair vivṛtam punaś ca

prakāśaye 'ham karaṇam laghīyaḥ /

Vakyakarana II (*Prakṣiptādhyāya*) (kar.), ch. VI, in 37 interpolated verses. Ms. See edn. Edn. By T.S.K. Sastri and K.V. Sarma, as App. to the edn. of *Vakyakarana*, above.

Vakyakarana III, related to *Vakyakarana* II. Ms. Ker. P. 955.

Viśvanātha Bhaṭṭa

—*Keralaratnamañjarī*

Veṅkaṭeśa, of the Kāśyapagotra, pupil of Acyuta I

—*Keralīgrantha*, *Uḍudāyapradīpa* or *Jātakacandrikā*

—*Devakerala* of Acyuta II, redaction of Part II

Vyāsa

    —*Keralīśakuna*

Śiva

    —*Keralamata*

Śukra Ācārya

    —*Keralajātakānanda* or *Keralarahasya* or *Śukrakerala*

Śukrakerala : See *Keralajātakānanda.*

Śrī (?)

    —*Keralasūtra* or °*śastra*

Sarvartu Paṇḍita, protégé of Gopāla of Vijayanagar.

    —C on *Keralahorā*

Sundararāja, Astronomer of the Tamil country, resident of the banks
of river Kāverī, son of Anantanārāyaṇa and protégé of
Somadeva ; admirer and contemporary of Nīlakaṇṭha Somayāji,
with whom he had correspondence on astronomical problems
(see above, pp. 175-76, *Sundararāja-praśnottara* by Nīlakaṇṭha
Somayāji).

    —C I, *Laghudīpikā* or *Laghuprakāśikā* on *Vākyakaraṇa* of
       Vararuci III.

    —C II *Sundararājīya* or *Vasanāprakāśikā*, a more extensive
       C on *Vākyakaraṇa* of Vararuci III.

Ref.   T. S. K. Sastri and K. V. Sarma, Intro. to *Vākyakaraṇa*,
       Madras, 1962.

Note. Since most of the works noticed above are anonymous,
      that fact is not indicated against each work with the symbol
      'anon'. However, when the real or apocryphal author
      of a work is known, the fact is duly indicated.

SUBJECT INDEX

[NOTE : The entries in the bibliographical chapters, *viz.*, chs. V-VI (pp. 82-196) are, by themselves, arranged according to the Devanāgari alphabet and, so, are not included in this index. They might be referred to directly. Numbers in thin type indicate casual references and those in thick type to detailed notices.]